Report on the Cephalopoda obtained by the F.I.S "Endeavour" in the Great Australian Bight and other Southern Australian Localities.

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Plates LIX.-LXXXVIII.; Figs. 1-67.

REPORT ON THE CEPHALOPODA.

I.—INTRODUCTION.

THROUGH the kindness of Mr. R. Etheridge, Junr., Director and Curator of the Australian Museum, I have had entrusted to me for examination and report the considerable collection of Cephalopods, about a kegful in all, taken by the F.I.S. "Endeavour" on her various expeditions prior to her last ill-fated voyage in 1914.

The collection, which comprises one hundred and four specimens, may be summarily outlined in the following table :—

TABLE I.

	Families.	Genera.	Species.	Individuals
Oegopsida................	3	3	3	35
Myopsida................	3	4	6	31
Octopoda.................	2	2	4	38
Total..............	8	9	13	104

On the whole the material is in good condition, though the choice of formalin solution as a preserving medium has resulted in irreparable damage to many specimens, some of which were of great value, while all have been rendered correspondingly difficult and disagreeable to work with. It is most curious how differently formalin seems to behave toward the tissues of different groups of animals. While so often satisfactory with some other groups, I can find little to commend its use with most Cephalopods, or any of them, unless it be with some of the more delicate and transparent pelagic forms, or as a temporary fixing agent.

Fortunately all except three of the species are represented in the collection by a fair number of specimens, a circumstance which has made possible much more thorough and satisfactory work than would otherwise have been the case.

II.—SYNOPSIS OF THE COLLECTION.

The following species of Cephalopods were obtained by the "Endeavour" and will be treated in the succeeding pages :—

Class CEPHALOPODA.

Order DIBRANCHIATA.

Suborder DECAPODA

	Division OEGOPSIDA.	
	Family ENOPLOTEUTHIDÆ.	
	Subfamily ENOPLOTEUTHINÆ.	
	Genus Enoploteuthis, *d'Orbigny* 1844.	
1.	Enoploteuthis galaxias, *sp. nov.*	4
	Family HISTIOTEUTHIDÆ.	
	Genus Calliteuthis, *Verrill* 1880.	
2.	Calliteuthis miranda, *sp. nov.*	1
	Family OMMASTREPHIDÆ.	
	Genus Nototodarus, *Pfeffer*, 1912.	
3.	Nototodarus gouldi (*McCoy* 1888)	30
	Division MYOPSIDA.	
	Family LOLIGINIDÆ.	
	Genus Loligo, *Schneider* 1784.	
4.	Loligo etheridgei, *sp. nov.*	2
	Genus Sepioteuthis, *Blainville* 1824.	
5.	Sepioteuthis australis, *Quoy and Gaimard* 1832.	1
	Family SEPIOLIDÆ.	
	Subfamily Rossiinæ.	
	Genus Rossia, *Owen* 1834.	
	Subgenus Austrorossia *nov.*	
6.	Rossia australis. *sp. nov.*	5
	Family SEPIIDÆ.	
	Genus Sepia, *Linnæus* 1758.	
7.	Sepia hedleyi, *sp. nov.*	15
8.	Sepia dannevigi, *sp. nov.*	3
9.	Sepia chirotrema, *sp. nov.*	5
	Suborder OCTOPODA.	
	Family POLYPODIDÆ.	
	Genus Polypus, *Schneider* 1784.	
10.	Polypus *cf.* australis (*Hoyle* 1885)	1
11.	Polypus variolatus (*Blainville* 1826)	9
—	Polypus, *sp., juv.*	6
	Family CIRROTEUTHIDÆ.	
	Genus Opisthoteuthis, *Verrill* 1883.	
	Subgenus Teuthidiscus, *nov.*	
12.	Opisthoteuthis pluto, *sp. nov.*	14
13.	Opisthoteuthis persephone, *sp. nov.*	8
	Total specimens	104

III.—Region Investigated.

The region covered by the explorations upon which the present paper is based includes the waters between Gabo Island, Victoria, on the east, and Cape Naturaliste, Western Australia, on the west. The bulk of the material, however, was taken in the Great Australian Bight south of Eucla, and in the immediate neighbourhood of Bass Strait.

IV.—Geographical Distribution.

The distribution of the various species, as well as a hint of their zoogeographic relationships further afield, is brought out as well as it can be at the present time in the accompanying table (Table II.). For the sake of completeness I include also such additional records for the species previously known as I have been able to glean from the literature. Explanations of the uncertainty indicated in some instances in the table will be given in proper order in the main body of the report.

TABLE II.

Species.	Torres Strait.	N. South Wales.	Victoria.	Tasmania.	South Australia.	W. Austr. (Bight).	W. Austr. (W. Coast)	Other Records.
Enoploteuthis galaxias.....			×					*affin.* Japan
Calliteuthis miranda......			×					*affin.* Indian Ocean
Nototodarus gouldi........		+	×	×	?	×		*affin.* New Zealand, Fiji, Hawaii (?)
Loligo etheridgei..........			?					*affin.* Indo-Malayan
Sepioteuthis australis......	+	+	×				+	*affin.* Indian Ocean
Rossia australis..........			×			×		*affin.* Brit. E. Africa
Sepia hedleyi............					×	×		*affin.* ?
Sepia dannevigi..........					×		×	*affin.* ?
Sepia chirotrema.........					×	×		*affin.* South Africa
Polypus cf. australis......		×	?					New Zealand ?
Polypus variolatus........		+	×	×		×	+	Amboina ; Ceylon
Opisthoteuthis pluto.......					?	×		*affin.* Indo-Malayan
Opisthoteuthis persephone			×		?			*affin.* Japan

× .. Records based upon material obtained by the "Endeavour."
+ .. Previous records.

V.—Bathymetric Distribution.

Most of the Cephalopods taken by the "Endeavour" are from the upper oceanic strata, that is, from above the 100 or 150 fathom line. By adopting an increment of 150 fathoms as the standard, and placing the first three such increments in successive parallel columns with their appropriate species listed below, all the "Endeavour" material arranges itself with great simplicity in the three columns. *Nototodarus gouldi*, *Loligo etheridgei*, *Sepioteuthis australis*, all the *Sepiæ*, and the *Polypi* fall in the first column (0-150 fathoms). In the second (150-300 fathoms) appear *Enoploteuthis galaxias*, *Calliteuthis miranda*, *Nototodarus gouldi*, *Rossia australis*, *Sepia hedleyi*, the *Polypi*, and the two *Opisthoteuthids*. The third column, which includes depths from 300 to 450 fathoms, the most profound at which Cephalopods were taken, contains only a *Sepia*, *Nototodarus gouldi* and *Opisthoteuthis pluto*.

But, although the "Endeavour's" trawling data do not compose themselves in any other way quite so easily, it is apparent that a better comprehension of the true vertical distribution of the species, especially for correlation with future work, may be attained by preparing a table on the basis of 100-fathom increments. This is accordingly done in Table III, and it at once brings out what the simpler arrangement could not do, the empty spaces as well as the solid facts of our knowledge. The circumstance that *Nototodarus gouldi* is the only species appearing in all five columns is alone perhaps indicative of the incompleteness of the table. Again, were our data far more extensive than they are, they can afford us only a poor picture of the reality until we are able to take into account the complex and still almost wholly unknown phenomena of vertical migration, both seasonal and diurnal.

TABLE III.—BATHYMETRIC DISTRIBUTION.

	Depth in Fathoms.				
Groups.	0-100	100-200	200-300	300-400	400-500
Oegopsida	.... *Nototodarus gouldi*	*Enoploteuthis galaxias* .... *Nototodarus gouldi*	*Enoploteuthis galaxias* *Calliteuthis miranda* *Nototodarus gouldi*	.... *Nototodarus gouldi*	.... *Nototodarus gouldi*
Myopsida	*Loligo etheridgei ?* *Sepioteuthis australis?* .... *Sepia hedleyi* *Sepia dannevigi* *Sepia chirotrema*	.... *Rossia australis* *Sepia hedleyi* *Sepia dannevigi* *Sepia chirotrema*	.... *Rossia australis*	.... *Sepia (hedleyi ?)*	.... *Sepia (hedleyi ?)* ....
Octopoda	[*Polypus australis*] *Polypus variolatus* *Polypus juv.*	*Polypus ct. australis* *Polypus variolatus* *Polypus juv.* *Opisthoteuthis pluto* *Opisthoteuthis persephone*	.... *Opisthoteuthis persephone*	.... *Opisthoteuthis pluto*	.... *Opisthoteuthis pluto* ....

Note.—Entries bracketed are based on records previous to those of the "Endeavour."

VI.—Relationship of the Fauna.

It will be noted that the new or little-known species obtained all belong to genera already known from other parts of the world, for the most part widely distributed groups. The two exceptions are, however, noteworthy. *Nototodarus* is a remarkable genus of the *Ommastrephidæ*, the characters of which have but recently been made known, while its species have heretofore been reported only from Fiji and New Zealand. It is therefore very interesting to learn, through the discovery of males of this species, that the old *Ommastrephes gouldi* of McCoy is apparently referable here, its remarkable hectocotylized arms attaining a complexity in their fully formed condition beyond anything previously known for the entire family. That the material of this species includes enough growth stages to throw considerable light upon the development of these structures is a fortunate circumstance.

The other exception referred to is a beautiful new species of the typical group of *Enoploteuthis*. Until now this genus has been known only by a South Atlantic representative, a Japanese species, and a very old unconfirmed record of its occurrence in the South Pacific. The Japanese species appears to bear the closest relationship to the Australian form.

Also worthy of special mention is the occurrence of a *Rossia*, the second member of the genus to be brought to light from the southern hemisphere. Its predecessor is *R. mastigophora*, Chun, from the Indian Ocean (Lat. 0°27′S., Long 42°47′E.). The two species are very nearly allied, but appear so sharply marked off from their northern congeners that a new section or subgenus is here proposed for their reception.

The Indian Ocean fauna is brought to mind not only by this *Rossia*, but by much of the remainder of the collection. Yet our information seems still too scanty to enable us to say more than this regarding the zoogeographic relationships of the fauna as a whole. *Nototodarus* would appear to constitute an important South Pacific element.

To attempt at this time to work out a system of faunal zones on the basis of the distribution of the Cephalopoda, or even to try to bring them into correlation with those which have been established for other groups, as notably for the lower Mollusca by C. Hedley and for the Echinoderms by H. L. Clark, would be sadly premature, and could result only in confusion. This must wait for further work.

Except for the "Challenger" investigations, so little serious work has been done on the Australian Cephalopod fauna since the pioneer voyagers, and so much of the early work is uncertain and halting, even when judged by the prevailing standards of its period, that the subject is in much confusion and needs careful elucidation by someone having access to the older types. For instance, the redescription *and figuring* in modern fashion of the long list of species "described" by Gray, among them many Australian forms, would be a genuine service to science, and one far more deserving the gratitude of students the world over than any such contribution as the present one of mine can ever be. The worker with the Australian fauna is constantly handicapped and discouraged by the impossibility from the literature alone of accurate definition of so many of the older species. In the littoral groups particularly he cannot always escape a lurking fear that in describing a "new" species he is but adding another name to the burdened synonymy, however much he may feel that he cannot do otherwise without further augmenting the general uncertainty and confusion.

At any rate, few regions of equal extent in the world have a Cephalopod fauna so poorly known as is that of Australasia. For this reason, if no other, the present collection is of notable value, and while it can be regarded as only a beginning of the work which must be done, its investigation has seemed to the author worthy of the utmost care and attention within his power to bestow.

Perhaps the most surprising incident concerning the collection is the comparative scarcity of the two usually so abundant genera, *Polypus* and *Loligo*, together with the almost complete absence of *Sepiolidae*. To find more *Opisthoteuthis* than *Polypus*, twice as many *Enoploteuthis* as *Loligo*, and no *Euprymna*, is, at the least account, unexpected.

With but one, or perhaps two, exceptions, none of the species obtained by the "Challenger" were taken by the "Endeavour."

VII.—New Taxonomic Terms Proposed.

Taxonomic terms proposed for the first time in the present paper are as follow :—

Enoploteuthis galaxias, new species.
Calliteuthis miranda, new species.
Loligo etheridgei, new species.
Austrossia, new subgenus of *Rossia*, with *R.* (*A.*) *australis* as type.

Rossia australis, new species.
Sepia hedleyi, new species.
Sepia dannevigi, new species.
Sepia chirotrema, new species.
Teuthidiscus, new subgenus of *Opisthoteuthis*, with *O.* (*T.*) *pluto* as type.
Opisthoteuthis pluto, new species.
Opisthoteuthis persephone, new species.

VIII.—ACKNOWLEDGMENT.

My thanks are due not only to Mr. R. Etheridge for rendering possible my work upon the collection in the first instance, but likewise to Mr. Charles Hedley, also of the Australian Museum, whose ever-ready helpfulness in every possible direction has kept me constantly his debtor. In spite of our distance from one another his aid has been invaluable throughout the course of my work.

I must also express my gratitude to Mr. Robert N. Wenzel, of Stanford University, whose help during a critical time accelerated by many months the completion of this report. His work with the drawings, as well as that of Mr. Herbert J. Powell, of Redlands, California, constitutes its own acknowledgment, and shows how completely each artist by his painstaking care overcame his initial unfamiliarity with the technique of zoological illustration. Without the services of these two the work in the scope in which it is now offered would certainly not have been possible.

For the gift of several items of badly needed literature I am indebted to Mr. Hedley, to Mr. Etheridge, and to Mr. James A. Kershaw, Assistant Director of the National Museum, Melbourne.

IX.—Description of the Genera and Species.

Phylum MOLLUSCA.

Class CEPHALOPODA.

Order DIBRANCHIATA.

Suborder DECAPODA.

Division OEGOPSIDA.

Family ENOPLOTEUTHIDÆ.

Subfamily ENOPLOTEUTHINÆ.

Genus Enoploteuthis, *d'Orbigny*, 1844.

Enoploteuthis, d'Orbigny, in *Rüppell* 1844 (*teste* Hoyle).

Enoploteuthis galaxias, *sp. nov.*

(Plates lix.-lx.).

Animal small, its *Body* firm and fleshy, cylindro-conic in outline ; usually widest anteriorly, thence tapering rapidly past the fins to a soft, attenuate point behind. Anterior edge of mantle smooth, but broadly emarginate ventrally between the obtuse points into which it is produced on either side of the funnel, while again in the nuchal region it is extended to a rounded obtuse point. *Fins* large and triangular, individually longer than broad ; maximum length about one-half that of the mantle, the distance from tip to tip across them about two-thirds the mantle length ; outer angles sharply rounded ; anterior margins slightly convex and cut in where they join the body to form a somewhat angular anterior lobe ; posterior margins longer, slightly convex, joining the body at a point just in front of the end of the gladius but at a distance of perhaps one-fifth the mantle length from the extreme tip of the body.

Head squarish, moderate in size, a little longer than wide ; slightly convex above, concave below. Olfactory crest comprising a sinuous V-shaped fold, the dorsal segment commencing at the hinder dorso-lateral angle of the head, the ventral segment longer and more sinuous ; a similar but simple crest extending up from the ventro-lateral angle, not quite meeting the one first described. *Eyes* large,* the circular or oval lid opening with a conspicuous sinus in front.

Funnel large, broad, blunt at the apex, and notably swollen ventrally. The tip does not quite attain a level with the hinder margin of the eye-opening. Interior of funnel with a large flap-like valve on the dorsal wall near the apex. *Funnel Organ* (Pl. lx., fig. 7) of the usual triplicate form, a dorso-median ʌ-shaped organ and an elongate-oval ventro-lateral pad on each side. The organ of the specimen dissected differs from that of *E. chunii*, as figured by Ishikawa, in that the lateral pads are notably longer and narrower, while each arm of the dorsal pad bears a conspicuous elongate ridge along the middle of the anterior moiety. These ridges may possibly be an incident of the preservation, but for structures so produced the symmetry is unusual.

Arms graceful, moderately long, their formula of relative length 4, 3, 2, 1, or 4, 3=2, 1; the dorsal pair easily the shortest, thence increasing to the ventral pair, which are distinctly the longest, attaining somewhat less than two-thirds the mantle length. Dorsal arms with only traces of an outer carination near their tips; second pair with the carination developed into a narrow membranous keel, traceable along the distal half of the arm; third arms compressed, bearing a strong, broad keel all along their outer angles; ventral pair with the tentacular sheath continuing as a broad membranous fold along the ventral outer angles of the arms to their tips. All the arms armed for the greater part of their length with two regularly alternating series of well-spaced, medium-sized hooks, succeeded at the extreme tips of the arms by minute suckers (Pl. lx., fig. 3), the basal one-sixth or so of the arms devoid of either hooks or suckers; number of hooks varying on the different arms from 15 to 17 pairs in the ♀, and 12½ to 15 in the ♂, these sexual differences, if they are to be regarded as such, being set forth in detail in Table IV.; distal 4-5 mm. of the arms occupied by suckers, of which 6-10

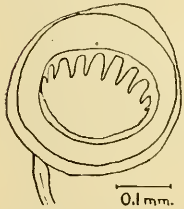

Fig. 1. — *Enoploteuthis galaxias* ♀ [462], sucker of third pair from base on right second arm; camera drawing from a mount in balsam.

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*In one of the specimens the right eye and lid opening are conspicuously larger than those of the opposite side, and while none of the other specimens show this feature to so great degree, in all the right eye and aperture are somewhat the larger. Whether this is accidental or indicates a condition approaching that characterising the *Histioteuthidæ*, I am unable to state from the present material.

pairs may be distinctly counted, their horny rings having each about 9-10 long, acute, slender teeth on the upper margin (Fig. 1). Hook and sucker-bearing faces of all arms bordered by delicate trabeculate swimming membranes, the ventral membranes of the third pair perhaps a trifle the best developed.

TABLE IV.—*Enoploteuthis galaxias.*

		NUMBER OF PAIRS OF HOOKS PRESENT ON							
Sex.	Specimen.	Right Dorsal Arm.	Left Dorsal Arm.	Right Second Arm.	Left Second Arm.	Right Third Arm.	Left Third Arm.	Right Ventral Arm.	Left Ventral Arm.
♀	Type [543]	16½	16	16½	16½	17	16½	16	16½
♂	Paratype [544]	13	12½	13½	13½	15½	14	14½	15
♀	Paratype [462]	16	16½	16½	16½	16½	17	..	15
♀	[542]	16	16	16½	16½	17	17	15½	16

Hectocotylized Arm in the male (the right ventral) only slightly modified ; the basal seven-tenths seemingly normal in every way ; just above the 8th hook of the ventral row, the ventral marginal membrane suddenly thickened and widened to form an elongate, sinuous flap, at its maximum somewhat wider than the corresponding oral face of the arm, becoming suddenly narrower at the 13th hook and then continuing only slightly wider than usual to the sucker-bearing portion of the arm ; dorsal membrane homologously modified, the enlargement beginning a little further distally, opposite about the 10th hook, at first becoming somewhat more ample and sinuous so as to give the appearance of forming two rounded lobes, but not reaching its maximum till a third lobe which begins opposite the 12th hook, continuing to the 14th ; the latter membrane here semilunar in outline and at its widest point, opposite the 13th hook, about twice as wide as the arm face though not so wide as is the ventral membrane at its widest expansion. The last three pairs of hooks and the first sucker or two are crowded between the membrane so as to appear practically in single file. The modified membranes appear to lose their trabeculate structure, perhaps because the cross bars are not thickened in proportion to the intervening regions of the membrane, since under an exceptionally favourable light, I am almost persuaded that traces of them are distinguishable. At the extreme tip of the arm seems to return to the normal condition (Pl. lx., figs. 4-5).

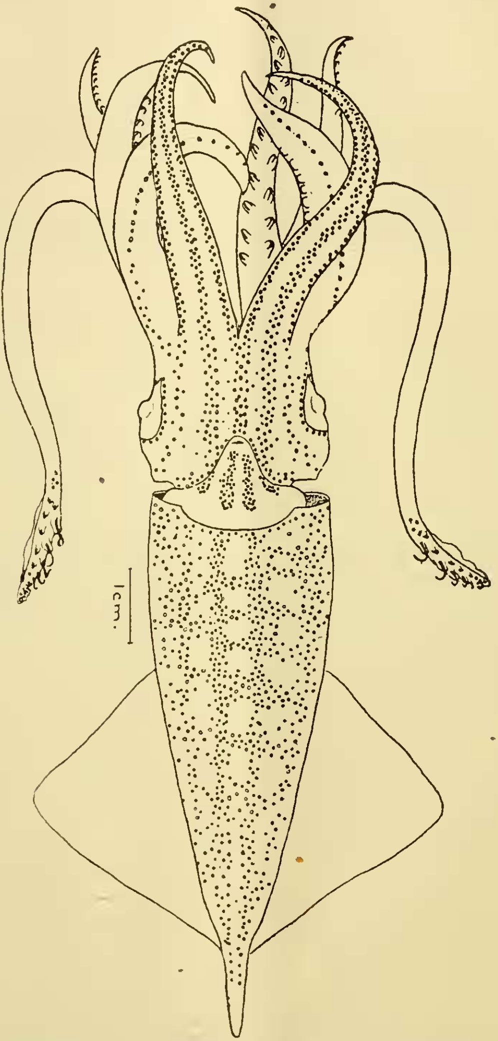


Fig. 2.—*Enoploteuthis galaxias* ♀ [543], [462], somewhat schematic drawing of ventral aspect to show arrangement of integumentary photophores; composite sketch from type and paratype.

Tentacles stout, fleshy, a trifle longer than the mantle, or a little over half as long again as the ventral arms ; stalks rather flattened dorso-ventrally so as to give them a somewhat rectangular outline in cross section, while they are considerably deeper than wide at the base, whence they taper to just before the carpus, the latter region very slightly wider. Tentacle *club* again narrower than the carpus, slender, and tapering rapidly to the extremity as in previously described species of the genus. Carpus with a compact fixing apparatus of 4-6 suckers and 4-5 pads occupying (as seen by a strongly oblique lighting), a somewhat sharply delimited, flattened, oval area on the oral face, and so crowded together within this area that it is sometimes very difficult to distinguish the true pads from certain (usually more irregular) roundish swellings arising in connection with the bases of most of the suckers (Pl. lx., figs. 1, 2). Club proper (Pl. lx., fig 2) with two alternating series of hooks along its proximal four-fifths ; ventral series comprising a small proximal hook succeeded by five conspicuously larger, long, slender, strongly curved hooks, the second and third the largest of the series, the remainder gradually diminishing in size ; dorsal series comprising five much smaller hooks of which the second is the largest, the distal ones very gradually diminishing in size ; no suckers proximal to the hooks in either series, or between the hooks and the fixing apparatus, in any specimen examined, but two of the four perfect tentacle clubs (Pl. lx., fig. 1) show a small sucker similar to the suckers of the distal portion of the club just distal to the hooks of the dorsal series and occupying a position opposite the space between the two most distal hooks of the ventral series, the presence or absence of this sucker apparently depending respectively upon whether the first hook of the dorsal or of the ventral series is the more proximal in its position upon the club and relative to the first hook of the opposite row, hence the said sucker no doubt is homologous with the sixth hook of the ventral series. Distal seventh of club occupied by four rows of small, closely-placed suckers, counting some 38-43 in all, which gradually diminish in size toward the extremity, except that a roughly defined circle of some 5-6 suckers almost at the tips (usually followed by one or two more minute suckers) are again somewhat larger than those just preceding them.

TABLE V.—ENOPLOTEUTHIS GALAXIAS.

ARMATURE OF TENTACLES.

Sex.	Specimen.	Suckers in fixing apparatus.	Pads in fixing apparatus.	Suckers proximal to hooks in dorsal row.	Suckers proximal to hooks in ventral row.	Hooks in dorsal row.	Suckers distal to hooks in dorsal row.	Largest hook in dorsal row.	Hooks in ventral row.	Largest hook in ventral row.	Total Suckers on distal part of club
♂	Paratype [544]—										
	right........	6	4	0	0	5	0	2	6*	3 ?	43
	left..........	5	5	0	0	5*	1	2	6	2	38
♀	Type [543]—										
	right........	4	5	0	0	5*	1	2	6	2	39
	left..........	—	—	—	—	—	—	—	—	—	—
♀	Paratype [462]—										
	right........	—	—	—	—	—	—	—	—	—	—
	left..........	3 (+1 ?)	4	0	0	5	0	2	6**	3	41

*This series begins first proximally.

**One hook apparently torn away is included; this series also begins first.

NOTE.—It is difficult to state which are true pads and which irregularly swollen cushions at the sides of the sucker bases in the carpal apparatus, the table figures for these structures being therefore in some degree a guess. It should be further noted that the basalmost hook of the ventral row on the main portion of the club is, in every instance, a very much smaller organ than any of its successors. approximating the condition seen in the dorsal row, *Buccal Membrane* eight-pointed, thin, delicate, strongly rugose within, and very deep in colour owing to the large number of minute dot-like chromatophores covering its outer surface.

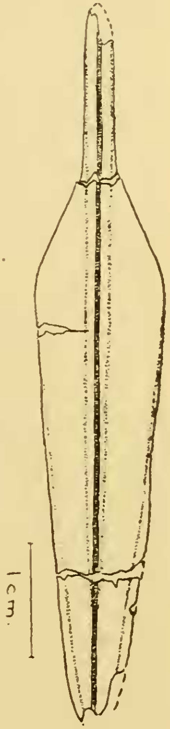


Fig. 3. — *Enoploteuthis galaxias* ♀ [462] gladius in dorsal aspect; represented with the wings spread flat.

Gladius (Fig. 3) horn-coloured, its midrib showing through the mantle integument as a conspicuous, dark, mediodorsal line, not extending into the soft hinder extension of the body; the free rhachis slightly less than one-fourth the total length; midrib flanked by a narrow thickening along it on each side and a weaker submarginal thickening on the wings; wings thin, broad, their margins obtusely angled at the widest point, somewhat less than two-fifths of the length from the anterior end.

Radula (Fig. 4) simply constructed, the marginal teeth having simple, arcuate, tapering blades; remaining teeth conical; of the latter, the median teeth broadest and longest, the first laterals narrowest and shortest.

Photophores divisible into two principal classes :—(A) those of the general integument, which are exceedingly numerous; and (B) a series of nine organs along the ventral periphery of each eyeball. Organs of the general integument (Fig. 2) distributed as follows :—(1) *Head and Arms* :—Ventral aspect of head with three bands of a depth of about three organs each, the median band splitting anteriorly into two forks running out the inner ventral margins of the ventral arms to their tips, and posteriorly into two forks along the boundary of the funnel groove; lateral bands continuing along the outer margin of the main body of the arms to their tips, each flanked outwardly by a narrower, less dense, more irregular band, this and its mate continuing along the outer ventral margins of the broad membranous keel of the ventral arms; ventral margin of eyelid on each side bordered by a single, closely-ranked series of photophores which skips across the lid-sinus and thence runs out along the outer angles of the third arms at the base of the outer keels. (2) *Funnel* :—Ventral aspect of funnel with two broad bands of closely-placed organs, 3-4 deep near the middle, flanked by a smaller, narrower band or patch at each side. (3) *Mantle* :—Entire ventral aspect of mantle covered with numerous, thickly scattered photophores, more so in some regions than others, but evincing slight traces of any aggregation into definite longitudinal stripes or bands, like those of the head and funnel; such traces best visible in the anterior region, but accompanied by an even stronger effect of an irregular transverse banding, so that in general the pattern here is best described as roughly checkered or reticulate; even this appearance being lost posteriorly; of the longitudinal bands the two median easiest to make out and traceable farthest back; the delicate posterior prolongation of the body adorned with comparatively few photophores, a line of the organs being evident down each side ventrally for about two-thirds of the distance to the tip, and two medioventral lines for about one-third the distance; the two latter series, with a space between them clear of photophores, traceable for a short distance forward on the body proper, soon losing themselves; dorsal region of mantle with a few scattered photophores; all the photophores, dorsal and ventral, unusually inconspicuous and little differentiated by their colour, though the fact that they usually form low tubercles helps to distinguish them; apparently divisible into at least two principal sizes, those of one type being very small. (B.) *Subocular photophores* (Pl. lx., fig. 6), 9 in number, occurring in a single, close ranked series on the ventral periphery of each eyeball; sufficient magnification showing them to be not exactly in line with one another, but zigzag and strongly polymorphic, the degree to which this appearance may be due to their different orientation in the encompassing tissues being somewhat uncertain; terminal organs largest, both characterised by their strongly fibroid structure with very

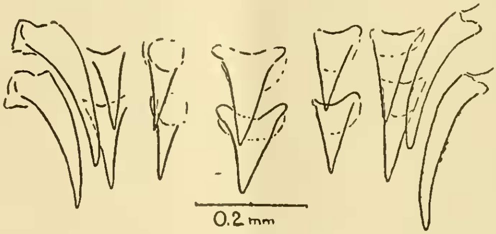


Fig. 4.—*Enoploteuthis galaxias* ♀ [462], two rows of teeth from radula of paratype; camera drawing from a mount in balsam.

definite outer boundaries, in this aspect the fibres appearing radially arranged only in the anterior organ ; 2nd and 8th organs little more than half the diameter of those just described, differing further (though in this as other respects similar to one another) in their granular rather than fibrillar structure within very definite circular boundaries, at one side embedded in a mass of indistinct fibrillae ; 4th and 6th organs seemingly of same general type as 2nd and 8th, but somewhat larger, the 4th being strongly displaced inwardly ; central organ resembling the 3rd and 7th, being considerably larger than these, though smaller than the terminal organs.

Colour of preserved specimens in general a dark purplish slate mottled with brown-red on a brownish buff ground ; fins brownish buff underneath and on the edges dorsally, the dorsal region of the body being very dark between them ; photogenic organs purplish slate ; the very numerous chromatophores, which extend even upon the oral surfaces of the arms and tentacle club, brownish red.

TABLE VI.—MEASUREMENTS OF *Enoploteuthis galaxias*.

Author's Register Number.........	[544]	[542]	[462]	[543]
	Paratype		Paratype	Type
Sex..............................	♂	♀	♀	♀
	mm.	mm.	mm.	mm.
Total length......................	172	..	178	180
Length of body, dorsal.............	73	87	78	72
Length of body, ventral............	68	85	73	67
Tip of body to base of dorsal arms..	91	111	95	93
Length of free tip of body..........	16	20	17	15
Length of fins......................	35	42	..	40
Width across fins...................	48	55	..	49
Width of body alone...............	21.5	23	19	25
Depth of body.....................	18	20	17	15
Width of head across eyes..........	16	17.5	17	19
Length of head....................	19	22	19	20
Length of funnel, median...........	14	15	14	13
Length of right dorsal arm.........	38	39	40	34
Length of left dorsal arm...........	38	41	39	35
Length of right second arm.........	40	45	43	41
Length of left second arm..........	40	47	43	41
Length of right third arm..........	40	46	44	41
Length of left third arm............	41	48	45	41
Length of right ventral arm........	46	51	..	46
Length of left ventral arm..........	46	51	49	46
Length of right tentacle............	78	..	..	78
Length of right tentacle club........	18	..	..	19
Length of left tentacle..............	74	..	80	..
Length of left tentacle club.........	18	..	20	..

Type :—a ♀, E5723 (pars) [S.S.B.543], in the collection of the Australian Museum, Sydney. A paratype [S.S.B.544] has been retained by the writer.

Type Locality :—200-250 fathoms, Gabo Island to Everard Grounds, Victoria; (" Endeavour "); 1 ♂, 2 ♀ ♀.

Recorded Distribution :—160-250 fathoms, region of Cape Everard, Victoria.

Material Examined :—

TABLE VII.

No. of Specimen	Sex.	Depth in Fathoms.	Locality.	Original Number.	Author's Register	Remarks.
1	♀	160-200	33 m. S. × W. of Cape Everard, Victoria.	E5601	[542]	
1	♀	200-250	Gabo Island to Everard Grounds, Vic.	E5723	[543]	Type.
1	♂	,,	,,	,,	[544]	Paratype.
1	♀	,,	,,	,,	[462]	Paratype (dissected)

Remarks.—One of the surprises offered by the "Endeavour" material was the occurence of no less than four adult specimens of both sexes of this rare and little known genus of Squids. Furthermore, although the species to which they belong is admittedly close to the Japanese *E. chunii*, Ishikawa (1914, p. 401), as well as to the type of the genus, the poorly understood Atlantic *E. leptura* (Leach) (cf. d'Orbigny, in d'Orbigny and Férussac, 1839, p. 337, Onychoteuthes, pl. 6, pl. 11, figs. 6-14, pl. 12, figs. 10-24), it still seems clearly distinct enough to be awarded a separate name. Its most conspicuous peculiarity lies in the arrangement of the photogenic organs of the ventral aspect of the body. These, although much more numerous and crowded than would seem to be the case in either of the older species, fail to show the aggregation into more or less definite longitudinal bands characteristic of both the latter. The specimens further differ from *E. chunii* in the more reduced sucker-bearing area on the sessile arms, the greatly diminished number of suckers on the terminal portion of the tentacle club, and the consequently smaller area of the organ occupied by them, the lack of small suckers between the carpal apparatus and the hooks on the main portion of the club, certain details in the number of hooks and relative position of the protective membranes on the hectocotylized arm, and so on. None of these peculiarities are very striking, but are relatively constant in the material seen, and have to do with organs of established dependability for their taxonomic value in this group of Squids. The hectocotylus of *Enoploteuthis* does not appear to have been previously figured, though that of *E. chunii* has been briefly described by Sasaki (1916, p. 91).

As in the present instance all the specimens were obtained in the same general locality, nothing is known concerning their distributional limits or the faunal region to which they properly belong.

To judge from the size and abundance of the photogenic organs this little squid must be brilliantly luminous in life. It is the most graceful and attractive Cephalopod in the "Endeavour" collection, in fact one of the most beautiful of the entire known Australian fauna.

The species receives its name from a fancied resemblance in the arrangement of the numerous photophores on the ventral aspect of the body to the stars of the Milky Way or Galaxy (Greek γαλαξίας).

Family HISTIOTEUTHIDÆ.

Genus Calliteuthis, *Verrill*, 1880.

Calliteuthis miranda, *sp. nov.*

(Plates lxi.-lxii.)

Animal of moderate size, of the form characteristic of the genus; the *Body* short, robust, broadly conical in outline, widest at or near the anterior margin, thence tapering rapidly to a stout point; mantle thick, its anterior margin rounded, with an anteriorly projecting sinuosity in the nuchal region and obtuse points at either side of the funnel, between the latter barely emarginate. Locking apparatus of the usual form, the funnel cartilages large and possessed of an unusually deep median excavation. *Fins* short, broad, semicircular; about 43/100 as long as the mantle, each separately about half as wide; meeting and fusing in the median line behind at a point well above and in front of the free tip of the body, which latter their indented margin slightly exceeds posteriorly.

Head enormous, strongly asymmetrical, though the normal deflexion of the axes of the head and body cannot be ascertained from the present material. *Eyes* large, strongly asymmetrical; right eye well developed, but the left extraordinarily so (Pl. lxii., fig. 1), its aperture approximately twice the longitudinal diameter of the right eye-opening, its lens 22.3 mm. in diameter, that of the right eye 12.3 mm.; just back of each eye a simple cylindro-conic "olfactory papilla." *Funnel* short and broad, extending about 30% of the distance from its base to the umbrella margin; supported above by a pair of wide, thin, membranous bridles, enclosing a deep pocket between them; valve of the usual flap-like form. *Funnel Organ* (Pl. lxii., fig. 3) comprising the usual pair of large ovate ventro-lateral pads and a large Λ-shaped pad with a pointed tip occupying most of the dorsal wall of the funnel chamber.

Arms stout, rapidly tapering; in general subequal, except that the ventral pair seem distinctly, though not greatly, shorter than the others, all being obscurely keeled. Suckers of the sessile arms (Fig. 5) hood-shaped, in two well-separated rows on all the arms; their horny rings armed on the superior margin with about twelve short, wide, battlement-shaped teeth, here and there sometimes coalesced so that the notches between them are reduced to mere nicks; diameter of one of the larger suckers, 3 mm. *Umbrella* (Pl. lxii., fig. 4) well developed, though short, extending about equally between the arms of the three dorsal pairs for perhaps one-quarter of their length; attached to the *inner* angles of the arms in such a way as to be continuous with their oral faces and quite invisible externally when the arms are closed. There is also a weak rudimentary umbrella between the *outer* angles of these arms, so that there is a sort of deep, conical pocket between the base of each arm and that of its next neighbour; this outer umbrella better developed between the third and fourth arms, where it forms the outer sheath of the tentacle, the inner umbrella here being absent, though reappearing in a rudimentary way ventrally as a triangular membrane filling the gap between the buccal membrane, its ventral buttresses, and the ventral arms. Between the latter the inner membrane is but scantily developed and about on a par with the again reduced outer membrane. Ventral oral margins of arms of third pair equipped with well developed swimming membranes, similar, though less developed membranes occurring on the free portions of the remaining arms continuously with the inner web above described.

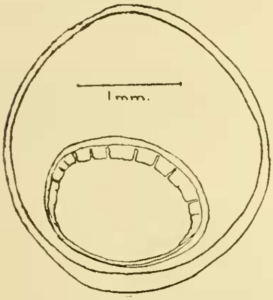


Fig. 5.—*Calliteuthis miranda* ♀ [545], seventh sucker from base in ventral row of right third arm of type: camera outline from a mount in balsam.

Tentacles stout, of moderate length, perhaps a third longer than the sessile arms ; at the base greatly compressed dorso-ventrally, so that their depth from the oral to the aboral surface is nearly three times the transverse dimension ; gradually tapering for about two-thirds their length, then becoming more triangular in section, due to the flattening and widening of the oral face in the region where the fixing apparatus commences : oral surface of tentacle at extreme base anchored by a slender cord of muscle (Fig. 7) originating in a sort of secondary pocket lying between the buccal membrane and the true tentacle pocket, and separated from the latter by a fleshy fold connecting the bases of the ventrolateral and ventral arms; the triangular space between fold, cord, and tentacle stalk filled by an extremely tenuous, transparent, veliform membrane, extending down on either side of the fold into both pockets, appearing to be firmly attached at all points ; entire oral face of stalk from intersection of basal muscle cord to the carpal region marked by a shallow but narrow and quite sharply delineated longitudinal groove in the median line. *Tentacle club* (Pl. lxii., fig. 2) spatulate, expanding near its base to about double the width of the carpus, thence tapering rapidly to a rounded point ; sucker-bearing area bordered on both sides by a well-developed marginal membrane, the dorsal membrane outwardly paralleled along the distal half of the club by a strong, flattened keel. Suckers on the club proper exceedingly crowded, apparently borne in six rows over the entire club except the greatly narrowed extremity where they are much reduced in size and appear in four rows, terminating in the usual apical group of 6-7 suckers somewhat larger than their immediate predecessors and circularly disposed ; largest suckers about the 4th-6th from the base of the two dorso-median rows, those in the series ventral to these becoming progressively smaller ; horny rings bearing numerous minute acute, pointed teeth (Fig. 6) around their entire circumferences,

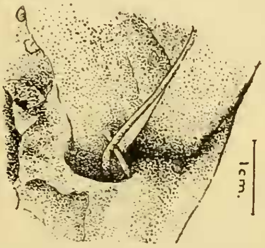


Fig. 6.—*Calliteuthis miranda* ♀ [545], base of left tentacle, showing accessory muscular cord and pouch.

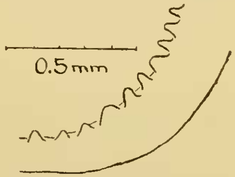


Fig. 7.—*Calliteuthis miranda* ♀ [545], portion of horny ring of tentacular sucker ; camera drawing from a mount in balsam.

the number of such teeth in the larger suckers being estimated as 50-60. *Fixing apparatus* (Pl. lxii., fig. 2) beginning distally on the dorsal margin of the club at its point of widest expansion, thence extending down the club and stalk for about one-fifth of the length of the tentacle ; again commencing distally, said apparatus comprises—first a minute sucker, then in turn a pad, a larger sucker, a pad, a considerably larger sucker (this being at the base of the sucker-bearing portion of the club proper), four pads alternating with three suckers equal to one another in size, but smaller than either of the two preceding ; alongside the last pad, though in a slightly distal horizontal plane and barely ventral to the median groove of the stalk is an exceedingly minute sucker ; a short distance below it and also almost in the groove a minute pad, followed in the same series next the groove by two larger but still quite small suckers, then two pads somewhat obliquely placed so that the two larger succeeding suckers are well spaced from the groove, then two pads leading back toward the groove, close by which we find the next two suckers and the concluding pad, the interspaces between these last being much greater than those preceding them ; summing up, entire apparatus divisible into (1) a dorso-marginal and distal series of six variously sized suckers alternating regularly and closely with six equal-sized pads, and (2) a ventro-median and more proximal series of seven relatively small suckers and six pads alternating in the peculiar order of 1-(1)-2-(2)-2-(2)-2-(1), the median members of the series somewhat displaced ventrally instead of all being in exactly the same longitudinal plane.

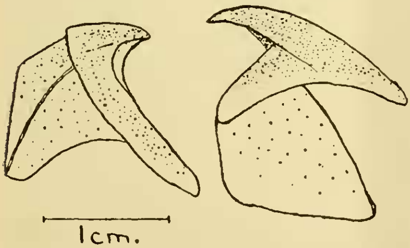


Fig. 8.—*Calliteuthis miranda* ♀ [545], camera drawing of mandibles.

Buccal membrane (Pl. lxii., fig. 4) very large, rugose within, 7-pointed, the lappets anchored by simple, unforked, membranous buttresses ; the three dorsal lappets inserted opposite the interspaces of the four dorsal arms, apparently anchored directly to the face of the inner umbrella, whereas the buttresses of the next pair of lappets are continuous with the ventral membranes of the third arms, and those of the ventral pair of lappets with the dorsal (outer) membranes of the ventral arms.

Gladius not examined, due to the crushed condition of the specimen.

Mandibles (Fig. 8) black; upper mandible with a slender curved beak; lower much shorter and stouter, and bearing a sharply raised median carina on its wings.

Radula (Fig. 9); median teeth with wide, hat-shaped bases and simple, sharp, conical cusps; first laterals also simple conic, but much smaller; second laterals conic at base, but their points attenuated to more than twice the length of the first laterals; marginals long, straight, knife-shaped, in their turn again nearly twice as long as the second laterals.

Photophores of the general integument many in number, but scattered rather than crowded, and more numerous and larger ventrally than above; partly owing, perhaps, to the condition of the specimen, any exact system of rows on the ventral aspect of the body or head I am unable to distinguish, the general arrangement having been represented by the artist as carefully as possible in the drawing (Pl. lxii., fig. 1); the series or groups capable of positive definition are:—A close-set submarginal series of seven organs between the ventro-lateral, points of the mantle, an arch of about six organs on the head bounding the apex of the funnel groove, a circlet of about sixteen bounding the right eye-opening, and at first five, then four longitudinal series of organs arranged in well-spaced transverse series along the ventral surface of each ventral arm; first two transverse series on arm proper containing five organs, next two four each, the number thereafter gradually diminishing; photophores surrounding left eye-opening fewer than on the right and greatly reduced in size, 7-8 minute ones distinguishable along the ventral border, but dorsally more difficult to make out; excluding circumorbital series, possibly the equivalents of 10-11 longitudinal series of photophores present on ventral aspect of head; on outer surfaces of the six dorsal arms, I make out two rows, one on either side of the cartilaginous ridges soon to be described; photophores absent from funnel.

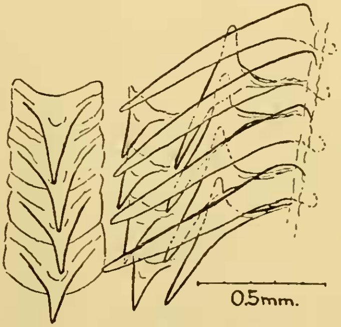


Fig. 9.—*Calliteuthis miranda* ♀ [545], four rows of teeth from one side of radula of type; camera drawing from a mount in balsam.

Surface of body smooth, except for the numerous small tubercles due to the photophores, and a longitudinal series of small, cartilaginous, tubercle-like spines beneath the skin along the medio-dorsal line extending about two-thirds of the way to the fins ; these tubercles are closely placed, as I count approximately twenty within a space of 40 mm. from the anterior margin ; a similar series of tubercles traceable along the basal 50 mm. of the median line of the upper surface of the dorsal arms, and traces of others are to be detected on the bases of the second and third arms.

General *colour* of specimen in formalin a dark, irregularly clouded, livid, purplish slate ; oral surfaces of arms and umbrella, and outer surface of buccal membrane uniformly darker ; suckers, sides of arms, sides of tentacles, and funnel grayish-brown ; photophores showing the usual dark tubercle with a lighter spot in front, but as a rule very inconspicuous.

Measurements.—

TABLE VIII.—MEASUREMENTS OF *Calliteuthis miranda.*

Author's Register Number	[545]
	Type.
Sex	♀
	mm.
Total length	450 (est.)
Length of body, dorsal	140
Length of body, ventral	135
Length of fins	60
Width of fin at widest point	30
Width across fins	75
Width of body	70
Width of head across eyes	50
Length of head	43
Longitudinal diameter of right eye opening	19
Longitudinal diameter of left eye opening	40
Length of funnel, median	30
Length of right dorsal arm	195
Length of left dorsal arm	200
Length of right second arm	200
Length of left second arm	210
Length of right third arm	200
Length of left third arm	195
Length of right ventral arm	180+
Length of left ventral arm	185
Length of right tentacle	260
Length of right tentacle club	35
Length of sucker-bearing area of right tentacle	80
Extent of fixing apparatus	56
Length of umbrella between dorsal arms, measured inside	50

Type.—A ♀, E5605 [S.S.B. 545], in the collection of the Australian Museum, Sydney. The specimen is unique.

Type Locality.—270 fathoms, S.E. × S. of Gabo Island, Victoria; ("Endeavour"); 1 ♀.

Remarks.—Although there are a good many named species of the genus *Calliteuthis*, *sensu latiore*, the great majority of these have been so ill defined that it has become exceedingly difficult to deal with the group at all. Any additional species described are therefore likely to be viewed with suspicion until it can conclusively be shown that they possess no counterpart among the melange of names applied to their various relatives. The specimen now before us I have accordingly tried to describe in as full a manner as the rather imperfect state of its preservation has permitted. Fortunately it possesses one character, the ridgepole-like series of cartilaginous tubercles on the dorsum and along the outer aspect of the four dorsal arms, which has been noticed heretofore in but two species, *C. meleagroteuthis* Chun, and *C. separata* Sasaki, both of which are members of the group *Meleagroteuthis* and thus differ conspicuously from the Australian species in many particulars, notably in the extraordinary development of their photogenic organs. In the distribution of these structures over its body *C. miranda* approaches much more nearly to *Stigmatoteuthis*, but even here does not rest comfortably unless we amend Pfeffer's diagnosis to include species with four as well as with three rows of photophores on the ventral arms. This, in fact, constitutes the second important peculiarity of *C. miranda*, and one in which, curiously enough, it would seem to stand unique. A third respect in which it differs from most if not all of the older species is in the extent and peculiar arrangement of the umbrella and accessory webs in relation to the arms, tentacles, and buccal membrane. This is most nearly resembled by the condition shown in Pfeffer's figure of his *M. hoylei*=*C. meleagroteuthis* Chun (cf. Pfeffer, 1912, Taf. 22, fig. 8), but differs in that the three dorsal lappets of the buccal membrane are not forked, but simple, and seem to spring directly from the umbrella rather than from the sides of the arms, while the umbrella itself appears somewhat more extensively developed. The apparatus at the base of the tentacles is not shown at all in Pfeffer's figure.

Just how much change these different structures undergo during the entogeny of the organism has not yet been worked out for any of the species, save to a certain degree for *C. reversa*, so we have still to face the possibility that such animals as *C. hoylei* Goodrich, and *C. chuni* Pfeffer are but young stages of some of the larger species. Compared to the one under discussion, however, the discrepancies are of such a nature (*e.g.*, the *fully* toothed arm suckers of *C. hoylei*, the *partially* toothed tentacle suckers of *C. chuni*, etc.) that I doubt whether either will ever prove identical with it.

C. miranda is not a typical *Calliteuthis*, as it lacks accessory chitinous structures on the tentacle club; it is not a typical *Stigmatoteuthis*, as it possesses the series of cartilaginous tubercles on the dorsum and dorsal arms, and there are too many series of photophores on the ventral arms; it is not a typical *Meleagroteuthis*, as there are far too few photophores over the whole body. In several respects it stands midway between the two latter groups and helps materially to break up the boundary between them. It shares with all other members of the family the extraordinary asymmetry of the eyes, head, and head photophores, a phenomenon which is still as inexplicable as ever.

Family OMMASTREPHIDÆ.

Genus NOTOTODARUS, *Pfeffer*, 1912.

NOTOTODARUS GOULDI (*McCoy*), 1888.

(Plates lxiii.-lxvi.)

? 1849. *Ommastrephes Sloanii*, Gray, Cat. Ceph. Brit. Mus., p. 61.

1881. *Ommastrephes Sloanei*, Verrill, Trans. Conn. Acad., v. 5, p. 386 (brief note).

1888. *Ommastrephes Gouldi*, McCoy, Prodr. Zool. Vict., Dec. 17, p. 227, 255, pls. 169-170.

1897. *Ommastrephes Gouldi*, Hoyle, Cat. Rec. Ceph., 1st Suppl., p. 371 [9] (merely catalogued).

1900. *Ommatostrephes sagittatus sloanei* (pars), Pfeffer, Syn. Oegops. Ceph., p. 179.

1912. *Ommatostrephes Sloanei Sloanei* (pars), Pfeffer, Monogr. Oegops. Ceph., p. 458-460 "(Göttingen" and "Petersburg" specimens).

Animal moderately large, loliginiform; its *body* (Figs. 10-11) slightly compressed, more or less cylindrical in front, tapering at first gradually, then very rapidly between the fins to an acute point; mantle margin with only a very weak nuchal sinuation and an emargination below the funnel.

Locking cartilages characteristically Ommastrephid in form. *Fins* quite large ; triangular when taken separately ; together sagittate and very slightly produced posteriorly ; their length 40-45%, their combined width 50-55% of the mantle length ; point of widest expansion at about the anterior quarter ; lateral angles rounded ; anterior margins convex, cut in next the body to form a lobe ; posterior margins at first slightly convex, then a little more strongly concave.

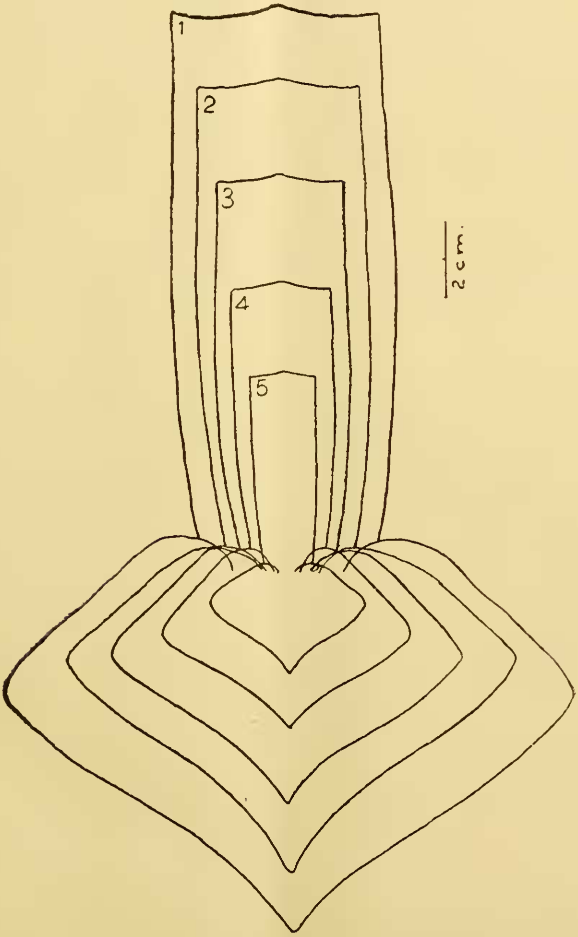


Fig. 10.—*Nototodarus gouldi* ♂, nested outlines of bodies of five specimens of various ages, dorsal aspect : 1—[549] ; 2—[552] ; 3—[564] ; 4—[550] ; 5—[563].

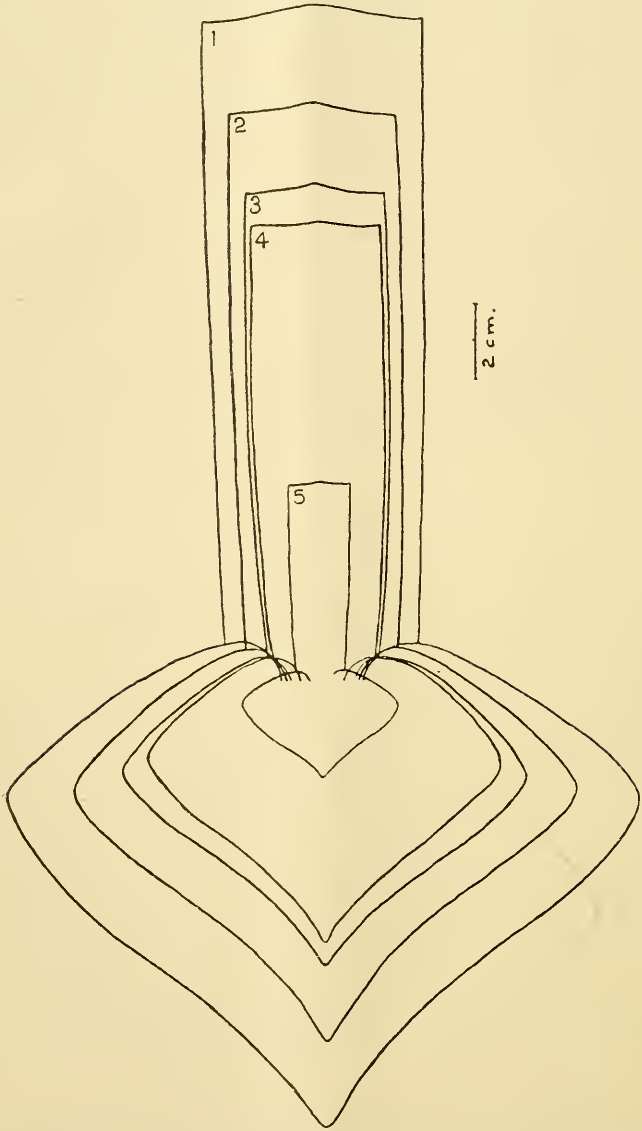


Fig. 11.—*Nototodarus gouldi* ♀, nested outlines of bodies of five specimens of various ages, dorsal aspect: 1—[548]; 2—[555]; 3—[556]; 4—[557]; 5—[563]. 5 is the specimen figured as No. 5 in the preceding figure, its uncertain sex causing it to be placed in both figures.

Head large, squarish, sometimes a little narrower than the body, but in the best preserved material probably more often a trifle wider; bounded posteriorly by a thickened ridge, corresponding to which is a less sharply defined angulation on the ventral aspect of the funnel; "olfactory crest" comprising the usual trident-shaped fold directly back of, adjoining, and pointing into the just mentioned ridge. *Eyes* large, with large lid openings, the latter having a sharply indented sinus in front (Fig. 12), at the base of which are borne little flaps (the ventral one considerably the larger) interlocking apparently so as to convert the apex of the sinus into a pseudo-pore. *Funnel* short, stout, broad; flattened, but furnished with the ventral elevation already described. *Funnel organ* (Pl. lxvi., fig. 1) very large, comprising an immense dorso-median, Λ-shaped organ and two elongate, ventro-lateral pads; phalanges of median organ long enough to jut past the lower margin of the funnel cartilages. *Funnel groove* with a distinct *foveola* (Pl. lxv., fig. 1), comprising a very shallow semicircular membranous fold cutting off the apical portion of the groove, the excluded portion bearing on its extreme apical wall a variable number (usually 6-8) of low, short, longitudinal ridges.

Arms of moderate length, fairly attenuate, their formula 2, 3, 4, 1, or, not infrequently, 2, 3, 1, 4; the second arms, which are longest, attaining about 60% the mantle length, the third pair slightly less, the dorsal and ventral pairs one-fifth to one-quarter shorter; keels well developed on the outer angles of all the arms, but reaching a maximum at about the basal third of the third pair; trabeculate marginal membranes also well developed, but those of the third pair not remarkably more than the others, except those of the ventral pair which are somewhat less conspicuous than the rest. Suckers of the sessile arms large, caldron-shaped, biserial, regularly alternating; the largest probably the 6th-7th pairs from the base on the second arms, those of the ventral arms smallest; about thirty-five pairs readily countable on the second arm of a large ♂; horny rings of larger suckers (Figs. 13, 17, 20) smooth below, but armed on their upper and lateral peripheries with a number of stout, acute, triangular teeth, varying from 9 in a ♀ of 180 mm. mantle length, to 12-13 in the larger specimens, the upper median tooth distinctly larger than the others, while

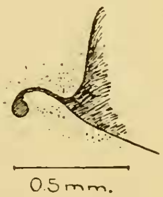
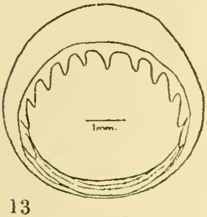


Fig. 12.—*Nototodarus gouldi* ♂, [553], sinus of left eye.

minute interpolated denticles between the ordinary teeth seem to occur only very rarely. True *Umbrella* wanting; tentacle sheath only weakly developed.

In the ♂ both arms of the ventral pair conspicuously modified (Pl. lxiv.; Pl. lxv., figs. 2-6; Pl. lxvi., figs. 3-6), perhaps as clasping organs. Right ventral arm, which is the true *Hectocotylus*, conspicuously differentiated into three main divisions—a heavily tuberculate basal region, a narrowed median sucker-bearing region, and a curiously pectinated distal portion which first expands, then tapers rapidly to an attenuate point. Taking a concrete instance to avoid the confusion which might ensue from the great variation in the details of these organs—in one of the larger examples before me [549] the right ventral arm has the suckers of the five proximal pairs missing (Pl. lxv., fig. 2), their original position evident from their immensely enlarged basal cushions, especially those of the ventral series which are vertical, acutely pointed, angular, and sharply carinated on the inner side, but with their outer faces deeply excavated (Pl. lxv., fig. 6), so that they much resemble the prows of small canoes stuck on end, although the proximal ridge on the outer side of each is not quite confluent toward the tip with the more distal ridge; on the proximal face near the point occurs a small elongate tubercle marking the original point of attachment of the sucker pedicel (Pl. lxv., fig. 2); corresponding cushions of dorsal row only a little more than one-half the height of the ventral cushions and more uniform in size, the former sucker bases on the other hand better developed so that the cushions are given a four-sided shape, all the ridges being very sharp; in the dorsal row the cushions gradually increase in size to the second or third, thence diminishing again, in the ventral row to the third or fourth, the difference in the size of the cushions being likewise more marked; sixth cushion in each series considerably smaller than those preceding it and bearing a small sucker. Next five pairs of suckers, except for their thickened, outwardly bifurcating bases and small size, relatively normal in their similarity to suckers correspondingly situated on the three dorsal pairs of arms; sucker-bearing face of arm here much narrowed, the lower portions of the basal cushions connected by a stout, upstanding, marginal web, abruptly terminating dorsally with the last of the sucker-bearing cushions (sucker missing from this cushion in the present specimen), but continuous ventrally to the tip of the arm (Pl. lxv., figs. 2, 4); remainder of arm of very different structure and, except for two suckers persisting in ventral series beyond their point of cessation dorsally, suckerless; cushions of dorsal series (Pl. lxv., figs. 2, 3, 4) immediately upon cessation of dorsal membrane more crowded, transversely compressed, their apices papillose, bases triangular, at the extreme base thin and plate-like, but swelling out almost immediately, especially on the dorso-distal angle, where a sort of raised knob is formed; proximal faces of these structures swollen and subangular, the distal faces hollowed out so as to fit each against the angle of the next distal cushion; beginning with the twelfth, the dorsal papillae increase gradually in size to about the 15th or 16th, slightly diminish to the 21st or 22nd, then again increase to about the 27th, whence they evenly diminish to the tip of the arm, a connecting web nowhere present; cushions of ventral series very differently modified (Pl. lxv., figs. 2, 3, 5), beginning with the 12th suddenly tranversely-elongate, pointed, slightly sinuous, flaring out like the teeth of a comb, though connected nearly to their tips by the strongly developed marginal membrane, giving them a ridge-like appearance; each ridge flanked proximally by a strongly incurved, membranous fold, beginning near the tip and running across to the distal face of the triangular dorsal "cushion" or papilla belonging to the next proximal pair so as to enclose a deep, transverse, trough-like groove; at inner termination of each ridge is a short, conical, somewhat distally directed papilla, indicating the point of attachment of the original sucker; the ridges described attain a maximum at about the 15th or 16th unit (enumerated from the extreme base of the arm), then diminish to the tip; they are somewhat longer than the opposite papillæ of the dorsal row. Left ventral arm in agreement with its mate in number, shape and size of the basal cushions, and in the lack of suckers on the five most proximal cushions, but with its distal portion normal throughout; length of this arm about one-quarter more than that of the right arm. Other adult ♂♂ agree very closely with the one described in general plan, but in the number of suckers lost and the number and position of those present as well as other minor details show so innumerable slight variations that a complete description of the hectocotylus of any one of them would not exactly coincide with that of any one of the others (an idea of the character and scope of this variation may be obtained from Table IX.). Gross number of enlarged proximal cushions, coincident point of cessation of marginal web and persistent suckers of dorsal row, and persistence of about two unpaired suckers distally in the ventral row, relatively constant in fully grown specimens.

Immature ♂♂ down to a mantle length of at least 115 mm. readily distinguishable from the ♀♀, though below a mantle length of perhaps 150 mm., their hectocotyli very different in appearance from those of adults. In the smallest specimen mentioned [550] the various types of modified cushions much less strongly developed than above described, the suckers borne the entire length of the arm ; proximal cushions passing into the little-modified sucker bases of the central portion of



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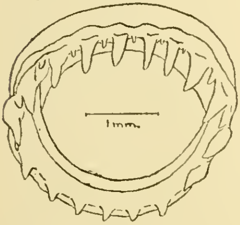

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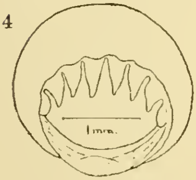

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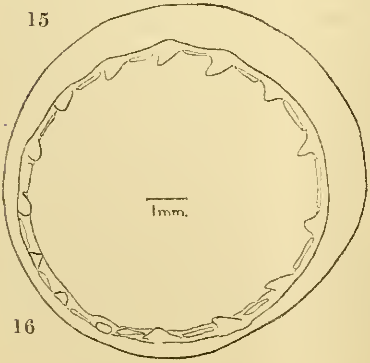

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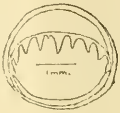

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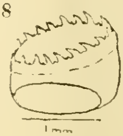

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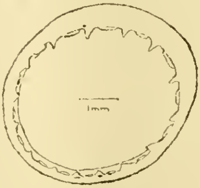

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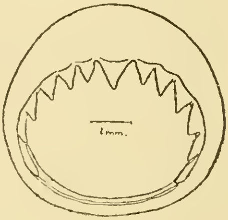

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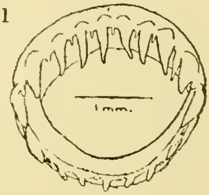

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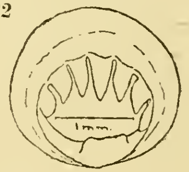

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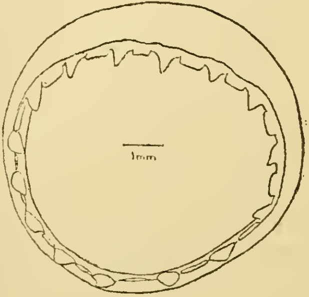

the arm so imperceptibly that they are scarcely to be separately distinguished except by their smaller suckers and sharper ridges on their outer surfaces, the same being true of the left arm as well ; on the right arm dorsal marginal web terminating at the 12th sucker, the succeeding papillæ (Pl. lxvi., figs. 5, 6) relatively weakly developed, for the most part bearing minute terminal suckers, though here and there a few are lost ; suckers of ventral series persistent to tip of arm, the ventral marginal membrane on this portion of the arm wide and trabeculate, the trabeculæ weakly duplex and very evidently the precursors of the comb-like ridges seen in the adult, although the membrane itself is here proportionally a more conspicuous part of the structure. Specimens intermediate in size between that just described and the fully formed adult give confirmatory evidence (Pl. lxvi., figs. 3, 4) that as the modified sucker bases gradually attain their final development, both the distal and proximal suckers of the arm gradually fall away, although in some specimens the loss would appear to take place in very irregular fashion (cf. Table IX.).

Fig. 13.—*Nototodarus gouldi* ♀ [548], horny ring of sixth sucker from base in ventral row of left third arm of largest specimen ; camera drawing from a mount in balsam.

Fig. 14.—Horny ring from dorso-marginal sucker of left tentacle club of same specimen, taken from approximately same horizontal level on club as that shown in Fig. 16.

Fig. 15.—Horny ring of second carpal sucker of left tentacle club of same specimen.

Fig. 16.—Horny ring of largest sucker on central region of left tentacle club of same specimen.

Fig. 17.—Horny ring of sucker of sixth pair from base of right second arm of a smaller specimen [519].

Fig. 18.—Horny ring of small marginal sucker from near middle of left tentacle club of same specimen.

Fig. 19.—Horny ring of large median sucker from near middle of left tentacle club of same specimen.

Fig. 20.—*Nototodarus gouldi* ♂ (549], horny ring of sixth sucker from base of ventral row of left third arm of large male.

Fig. 21.—Horny ring from dorso-marginal sucker of left tentacle club of same specimen, taken from approximately same horizontal level on club as that shown in Fig. 23.

Fig. 22.—Horny ring of second carpal sucker of left tentacle club of same specimen.

Fig. 23.—Horny ring of largest sucker on central region of left tentacle club of same specimen.

Tentacles variable, usually differing considerably from one another in longitude, the left (in the specimens at hand) almost invariably the longer, attaining a length from 70-98% that of the mantle ; more or less compressed, particularly near the base, and strongly keeled along their outer angles for their entire length, the keel reaching its maximum development on the distal half of the club ; oral face of stalk not flattened at base, though at a point about half way from the base to where the suckers begin there commence a pair of slight lateral thickenings which soon pass into the trabeculate lateral membranes of the sucker-bearing area ; sucker-bearing portion of tentacle about 60-70% of the entire length, about two-thirds of this comprised by the club proper. *Tentacle club* with suckers borne in four rows ; all the suckers of both marginal rows small ; about eight pairs of the central suckers much larger than the others, the 4th-5th pairs of these largest of all ; after the 8th pair, suckers of the two median series suddenly reduced so that thenceforth those of the ventro-marginal series are largest ; all suckers on distal one-third or so of the club relatively small, gradually diminishing in size dorsally and distally, finally terminating in an oval group of very minute, crowded suckers just proximal to the small apical cap of the club ; suckers of two median rows not changing in size with such abruptness proximally, but the eight large pairs succeeded by three pairs of evenly diminishing suckers, which, with the marginal series pass imperceptibly into two rows of very small suckers (some 4-6 pairs) on the carpus (Pl. lxvi., fig. 2) ; carpal suckers evincing a tendency to occur in alternating, but only slightly differentiated, sizes,

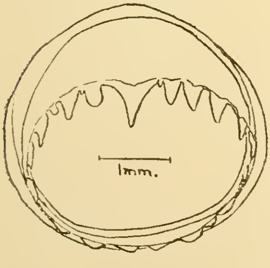

Fig. 24.—*Ommastrephes hawaiiensis* ♀ [243], horny ring of sessile arm sucker of type, viewed obliquely from upper side ; camera drawing from a mount in balsam.

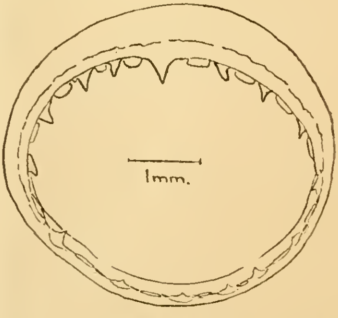

Fig. 25.—*Ommastrephes hawaiiensis* ♀ [243], horny ring from large tentacular sucker of type ; camera drawing from a mount in balsam.

TABLE IX.

Author's Register Number.. ...	[562]		[565]		[549]		[559]		[547]		[55[illegible]]		[554]		[564]		[566]		[550]	
Side of Arm....	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.	Dorsal.	Ventral.
Right Ventral Arm—																				
Total number enlarged basal tubercles..	6	6	6	6	6	6	6	6	–	–	4	5	6?	6[7]?	6	6	4	5	5?	5?
Basal tubercles without suckers........	4	4	6	5	5	5	4	5	3	4	0	1[5]	3	4	4	5	4	3	0	0
Basal tubercles with small suckers	1	1	0	0	0	1	1	0	2	1	3	4	2	1	0	0	1[8]	0	3	4
Basal tubercles with "normal" suckers............	1	1	0	1	1	0	1	1	2	1	1	0	1	1	2	1	1	0	2	1
Total number suckers..........................	7	9	2[1]	7	5	6[2]	7	8	9	–	17	3[8]	8	10	6	6	8	[illegible]	[illegible]	[illegible]
Suckers of "normal" size and with "normal" bases.	5	6	1[1]	5	4	5[2]	5	5	7[4]	–	7	5[6]	5	5	4	4	7	7	6[10]	7
Suckerless tubercles before dorsal web stops........	0	–	3	–	1	–	0	–	0	–	0	–	0	–	0	–	0	–	0	–
Last tubercle connected with dorsal web..........	11	–	10	–	11	–	11	–	12?	–	11	–	11	–	10		11	–	12	–
Last paired suckers.............	11	11	11	11	10	10	11	11	12	–	24	24	11	11	10	10	12	12[9]	?	?
Unpaired suckers persisting distally.......	–	2	–	1	–	2[3]	–	2	–	3	–	23	–	3		1	–	12		
Largest basal tubercle................	2	3	2-3	4	3	4	2-3	3-4	4	3-4	2-3	4-5	3	3	3-4	3	–	3	4	3
Largest distal tubercle........................	16 & 29	16-17	15	16-17	15 & 27	15-16	16	15	?	?	?	?	20?	19	14	15	16	15		
Left Ventral Arm—																				
Total number enlarged basal tubercles.............	6	6	6	6	6	6	7	7	7	7	5	6	6	7	6	6	5	5	5?	5?
Basal tubercles without suckers....................	3	4	5	5	5	5	4	4	3	4	2	1	4	4	4	5	2	2	0	0
Basal tubercles with small suckers.................	2	2	1	1	1	1	2	1	2	2	3	4	1	2	1	0	2	3	4	4
Basal tubercles with "normal" suckers............	1	0	0	0	–	–	1	1	2	1	0	1	1	1	1	1	1	0	1	1
Largest basal tubercle...:........................	2-3	3-4	2	3-4	2	3	4	5	3-4	5	3	4	6	4	3	3	3-4	4	4	4

1.—Suckers missing from tubercles 8-10.
2.—+ 1 median sucker missing.
3.—1 of these paired with 11th tubercle (suckerless) of dorsal row.
4.—10th cushion of dorsal row bears only a very minute, possibly abnormal, sucker, here included.
5.—The fifth.
6.—The 6th cushion is suckerless and is not included.
7.—Difficult to draw line here.
8.—The third: the sucker is very minute.
9.—These are the 13th-15th, 19th-25th, and 17th-28th, all but the first three excessively small.
10.—1 additional base, the 6th, from which sucker is missing.

the larger evidently a continuation of the two central rows the system just outlined), and comprising first a small pad, then three large ones in regular alternation with the suckers of this row on the basal portion of the club. Horny rings of atus sometimes so obscure as to be practically indistinguishable, but where best preserved finding its proximal beginning after the third sucker of the dorso-marginal row (counting on of the club, the smaller of the marginal rows. Fixing apparlargest tentacular suckers (Figs. 16, 19, 23) toothed all around with about 15 distant, short, stout, conical, pointed teeth, alternating with an equal number of short, wide, rectangular plates, the upper median tooth only very slightly larger than its neighbours. Horny rings of lateral suckers on the club proper (Figs. 14, 18, 21) very deep on the upper side and toothed all around with about 17 acute, conical teeth with swollen bases, which on the superior margin of the ring are long, slender, curved, and alternate with about 11-12 usually very minute, conical interstitial teeth becoming rudimentary and finally obsolete below. Horny rings of small carpal suckers (Figs. 15, 22) with relatively much smaller apertures than the other suckers, their upper margins armed with 7-8 very large, closely placed, conical teeth, the median apt to be somewhat the largest ; lower margins of these suckers expanded, not toothed, usually bearing an irregular ridge near the middle.

Buccal membrane well developed, seven-pointed, wrinkly rugose within.

Beak (Fig. 26) with strong black mandibles ; inner wings of ventral mandible with a supramedian depression, a weak ridge on the shoulder, and a narrow groove just below the summit.

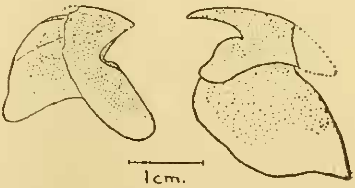

Fig. 26.—*Nototodarus gouldi* ♀ [510], camera drawing of mandibles.

Radula (Fig. 27) with tridentate median teeth, their central cusps a trifle over twice as long as the side cusps ; 1st laterals also tridentate, but their inner cusps originating more deeply than the outer and only about half as long, the central cusps about as long as those of the median teeth, but slightly oblique ; 2nd laterals with their principal cusps perhaps half again as long as those of the 1st laterals, each bearing a very weak side cusp at the inner shoulder ; marginal teeth with long, simple, slightly arcuate blades, a little over twice the length of the central cusps of the median teeth.*

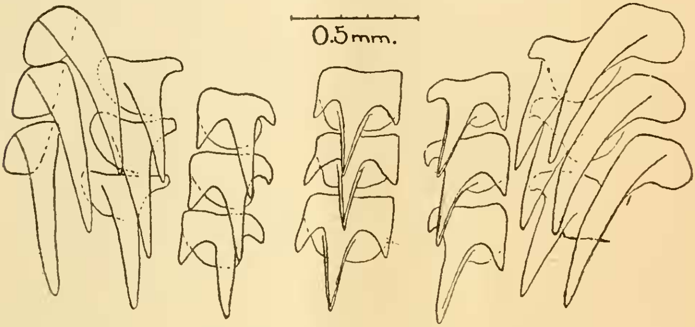

Fig. 27.—*Nototodarus gouldi* ♂ [564], three rows of teeth from radula ; camera drawing from a mount in balsam. No attempt is made in this drawing to show the marginal plates.

Gladius with the cone marked by numerous ridges and grooves, but not showing the definite division into three to four segments indicated by McCoy's figure.

Colour of preserved specimens similar to that of other *Ommastrephidæ*.

Measurements.—

Table X.—Measurements of *Nototodarus gouldi.*

Type.—In the National Museum, Melbourne (McCoy).

Type Locality.—Victoria (McCoy).

Recorded Distribution. — Sydney, New South Wales (? Pfeffer, as *Ommatostrephes Sloanei Sloanei*) ; Victoria (McCoy) ; Melbourne, Victoria (? Pfeffer, as *Ommatostrephes Sloanei Sloanei*) ; 60-220 fathoms, Bass Strait ("Endeavour"); 56 fathoms, Bay of Fires, Tasmania ("Endeavour") ; 70 fathoms off Cape Barren, Tasmania ("Endeavour") ; 75-80 fathoms, off Tasman Head, Tasmania ("Endeavour") ; 350-450 fathoms, Great Australian Bight ("Endeavour") ; 80-320 fathoms, off Eucla, Western Australia ("Endeavour").

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* In the radula of a large ♀ examined the teeth of the three median rows seem relatively longer and more slender than in the specimen figured.

TABLE X.—MEASUREMENTS OF *Nototodarus gouldi*.

Author's Register Number	[562]	[565]	[549]	[559]	[518]	[552]	[547]	[553]	[554]	[564]	[566]	[558]	[550]	[548]	[561]	[510]	[516]	[555]	[517]	[551]	[560]	[556]	[546]	[519]	[563]
Sex	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀	♀	♀	♀	♀	♀	juv.
Total length	mm. 590	mm. 575	mm. 560	mm. 475	mm. 505	m.m. 445	mm. 430	mm. 376	mm. 360	mm. 345	mm. 370	mm. 300	mm. 224	mm. 610	mm. 530	mm. ..	mm. 550	mm. 540	mm. 520	mm. 480	mm. 445	mm. 390	mm. 350	mm. 330	mm. 130
Length of body, dorsal	260	260	245	225	225	215	210	189	185	172	165	140	115	300	272	..	250	243	238	237	218	210	180	180	76
Length of body, ventral	250	250	240	215	210	205	204	185	177	169	205	132	110	285	263	260	240	238	235	230	210	200	178	175	72
Tip of body to base of dorsal arms	315	315	295	270	275	257	250	225	218	210	155	170	138	360	320	..	290	290	286	280	260	240	212	210	88
Length of fin	115	115	105	97	95	92	90	80	76	70	75	59	50	128	112	103	105	105	95	106	100	84	78	75	29
Width across fins	147	150	135	118	115	110	112	97	100	92	88	71	60	150	141	135	135	126	110	125	118	105	93	85	37
Width of body	51	..	57	44	52	49	41	34	36	32	43	31	24	61	53	..	45.5	46	43	48	46	39	32	30.6	17
Depth of body	62	..	57	42	42	33	39	30	32	30	43	24	24	53	46	..	47.2	53	40	40	39	34	29	28	16.5
Width of head across eyes	56	50	46	43	40	40	36	34	38	26	36	26	23	51	52	52	42.3	40	41.4	48	40	33	26	29	17
Length of head	47	40	50	40	47	43	35	31	31	34	35	25	21	55	41	35	41	50	43	43	40	30	28	25	13
Length of funnel, median	43	42	42	33	40	34	33	30	33	25	27	20	17	42	38	36	36	40	37	35	35	31	27	25	11
Length of right dorsal arm	122	118	127	101	115	92	92	75	81	75	83	55	46	135	100	112	115	122	110	117	116	78	66	63	26
Length of left dorsal arm	122	123	135	105	112	90	96	75	83	67	87	55	46	131	100	106	130	117	111	116	114	77	68	66	26
Length of right second arm	125+	139	160	132	130	111	123	101	106	90	104	70	58	158	125	139	135	145	130	141	124	100	92	86	32
Length of left second arm	140	165	162	130	135	112	121	100	104	90	103	68	56	158	125	140	160	148	134	138	127	97	92	80	32
Length of right third arm	148	130	148	119	133	105	120	100	102	90	97	70	55	..	120	..	145	143	130	127	120	92	82	85	31
Length of left third arm	141	150	150	120	139	117	120	90	97	86	96	66	54	153	118	137	140	139	128	128	120	95	86	73	31
Length of right ventral arm	120	125	112	99	106	85	90	72	80	70	76	53	39	125	109	115	120	115	117	114	115	81	74	72	25
Length of left ventral arm	135	135	138	105	117	102	105	75	86	74	78	55	46	128	108	107	122	113	117	115	113	80	77	67	25
Length of right tentacle	265	260	225	185	240	180	162	152	140	125	170	130	80	..	205	215	240	220	240	180	195	140	135	120	43
Length of sucker-bearing area of right tentacle	180	170	155	130	155	113	105	102	95	80	105	80	57	..	140	155	150	153	150	120	125	90	85	80	28
Length of left tentacle	215	250	270	210	220	185	195	157	140	140	178	125	86	245	185	..	240	240	245	208	185	162	150	120	42
Length of sucker-bearing area of left tentacle	145	170	175	145	146	120	118	107	95	90	115	80	57	160	135	..	160	165	152	140	115	100	90	80	28

Material Examined.—

TABLE XI.

No. of Specimens.	Sex.	Depth in Fathoms.	Locality.	Original Number.	Author's Register	Remarks.
1	♀	60-100	East edge of Bass Strait, Gabo to Babel Islands	E3076	[556]	
1	♂	,,	,,	E3077	[564]	
1	♀	,,	,,	E3078	[557]	
1	♂	,,	,,	E3079	[547]	
1	♀	100-220	,,	E3080	[519]	
1	♀	,,	,,	E3081	[546]	
1	♀	130-320	Long. 126° 35¼′ E., Great Australian Bight, S. × W. of Eucla, W.A.	E3608	[548]	largest ♀
1	♂	80-120	Long. 129° 28′ E., Great Australian Bight, S. of Eucla, W.A.	E3610	[511]	
1	♂	,,	,,	E3611	[558]	
1	♂	,,	,,	E3612	[512]	
1	♂	,,	,,	E3613	[562]	large ♂
1	♂	,,	,,	E3614	[518]	
1	♂	,,	,,	E3615	[565]	large ♂
1	♀	,,	,,	E3616	[510]	
1	♂	,,	,,	E3617	[553]	
1	♂	,,	,,	E3618	[549]	large ♂
1	♂	350-450	Long. 129° 28′ E., Great Australian Bight.	E3627	[566]	
1	♀	160-200	Long. 127° 8′ E., Great Australian Bight, . S. × W. of Eucla, W.A.	E4313	[517]	
1	♀	,,	,,	E4314	[555]	
1	♂	,,	,,	E4315	[559]	
1	♀	,,	,,	E4316	[516]	
2	♂ ♂	75-80	Off Tasman Head, Tasmania	E4879	[513]	
1	♀	56	Bay of Fires, Tasmania	E4884	[561]	Mar. 26, [1914
1	juv.	..	East slope of Bass Strait, between Gabo and Babel Ids.	E5342	[563]	
1	♀	70	20 m. east of Cape Barren, Tas.	E6062	[560]	
1	♂	,,	,,	E6063	[554]	
1	♀	64	Off Babel Island, Bass Strait	E6065	[551]	
1	♂	,,	,,	E6066	[552]	
1	♂	70	20 m. east of Cape Barren, Tas.	E6070	[550]	

Remarks.—I believe that this large South Australian Ommastrephid, the most plentifully represented cephalopod in the entire " Endeavour " series, is unquestionably referable to the *Ommastrephes gouldi* McCoy, although the discovery that *both* ventral arms in the male suffer the modifications collectively known as hectocotylization shows that the species must be transferred to the recently established genus, *Nototodarus* Pfeffer to constitute its second known species. I believe it to be probable from McCoy's description that he, himself, observed the peculiar double hectocotylus, as he speaks (1888, p. 256) of "the replacement of the suckers by tubercles on bases of two of the arms in some specimens," inferring this to be "accidental," but from the context it is perhaps not quite apparent whether he was here referring to his own species or to Gould's description of the related *O. insignis,* much misunderstood until its recent elucidation by Pfeffer. How so elaborately developed an organ as the hectocotylized arm in this species could possibly be construed as "accidental" is a bit difficult to understand, although it should be remembered that in McCoy's time, except for the brief observations of Gould, nothing resembling it had been described in the entire class *Cephalopoda.* Even now I am aware of no other œgopsid which boasts a hectocotylus of such complexity. Without actual observation of the animal in life, it would indeed be hazardous to speculate on the functions of its innumerable special modifications, but one is quickly struck with the notion that the hard, massive, jagged, in-facing tubercles so powerfully developed on the basal segments of both ventral arms (Pl. lxv., fig. 2) might well co-operate to form a most efficient clasping organ.

O. gouldi has not been reidentified with any certainty since its original description and consequently has never been properly understood or received general acceptance, despite the fact that, though somewhat stereotyped, McCoy's description and figures are really very good. The principal points wherein the present specimens fail to accord with his diagnosis are all to be explained, it seems to me, on the basis either of incomplete representation (as in the lack of a foveola in McCoy's drawing, the small number of grooves in the cone of the gladius, and the lack of interstitial teeth or plates in the tentacular horny rings), or as being within the limits of normal variation (as where the number of teeth in the marginal tentacular suckers is given as 20). McCoy also mentions that the arms in his specimen, except on the ventral margins of the third pair, are "without membranous borders." In the "Endeavour" material the ventral membranes of the third arms are simply a trifle wider than elsewhere.

Pfeffer, in his great monograph (1912, p. 459*), describes the

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*Pfeffer's description in full is as follows :—

"Das vorliegende Stück des Göttinger Museums von 170 mm. Mantellänge hat einen *hektokotylisierten rechten Ventralarm.* Die proximale Hälfte des Armes ist durchaus normal gebildet; die distale Hälfte ist stark umgebildet, und zwar in einer Weise, die sich von der Hektokotylisation des verwandten *O. sagittatus* beträchtlich unterscheidet. Betrachten wir zunächst die

hectocotylus of a small male Ommastrephid (mantle length 170 mm.) from Sydney in the Göttingen Museum, which he identifies with the New Zealand *O. sloanii.* Although the interpretation of some of his phrases is not exactly clear to me, while further he expressly states that the proximal portion of the right ventral arm is normal, leaving us to assume that the left ventral arm is entirely unmodified, his description of the distal portion of the arm so accurately describes the remarkable condition witnessed in young males, such as my 550 (Pl. lxvi., fig. 6), that I have hardly any doubt at all that his specimen is specifically the same. The "Endeavour" series is especially valuable in displaying the complete transition between the relatively little modified condition described by Pfeffer and that of the fully-grown adult.

This brings us to the question whether the South Australian species is not, after all, identical with the New Zealand form, and hence properly to be recorded under Gray's prior name *sloanii* as Pfeffer has done. This thesis I am not yet ready to support. Gray states distinctly that in his specimen from Waitemata the horny rings of the sessile arm suckers have the "higher side with *regular* acute teeth" (italics mine), and, while most of the rest of his description is in fair

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dorsale Langshälfte des Armes. Hier vermindert sich die Dicke des Armes ganz unvermittelt und schroff auf die Hälfte; demgemäss bricht der Schutzsaum der proximalen Hälfte hier auch plötzlich ab und verscheint, der Verdünnung des Armes gemäss, an anderer Stelle wieder, um nach einem Verlaufe, der dem Langsbereich von fünf Saugnäpfen entspricht, zu verschwinden. Nach aussen von diesem Schutzsaum, und über ihn hinweg geklappt, findet sich eine niedrig lappenförmige Erhebung des Schwimmsaumes, etwa in der Art, wie sie auf dem 3. Arme der meisten Oegopsiden aufzutreten pflegt. Die Basalpolster der dorsalen Napfreihe der umgebildeten distalen Hälfte des Armes richten sich senkrecht hoch, indem sie platte, in die Quere verbreiterte Schuppen bilden. Von diesen erheben sich, und zwar nach der Mittellinie des Armes zu sich scharf winkelig von ihnen absetzend, die sehr verlängerten, quer dreieckig verbreiterten Stiele der Saugnäpfe. Diese tragen Näpfe bis an die äusserste Spitze des Armes.

Die Näpfe der Ventralreihe des hektokotylisierten Armes blieben samt ihrem Stielen annähernd normal; dagegen ist der ventrale Schutzsaum mächtig entwickelt und, entsprechend den einzelnen Saugnäpfen, in einzelne zungenförmige Spitzen ausgezogen. Die Querstützen, sowohl die von der dorsalen wie ventralen Reihe der Basalkissen entspringenden, laufen als je ein Paar stark erhabener, durch eine Längsfurche voneinander getrennten Rippen über die orale Fläche und über den Schutzsaum hinweg in die zungenförmigen Zipfel hinein, schliesslich zusammenlaufend. Auf den distalen Viertel des Armes erscheinen die Zipfel zunächst weniger kräftig ausgeprägt; noch weiter distal tritt wieder der annähernd normale kontinuierliche Schutzsaum auf."

accord with the present specimens, his whole diagnosis is so brief, withal so deficient in its mention of truly critical points, that one cannot really be sure of even the generic position of his species, though I think it will very likely prove to be a *Nototodarus*. In view of these facts, science can surely gain nothing from a too hasty "lumping" of the various species. In the meanwhile Gray's type in the British Museum should be re-examined, re-described in detail, and adequately figured at the earliest opportunity. Pfeffer's statement on p. 459 (op. cit.) that "Es ist schliesslich die Möglichkeit nicht von der Hand zu weisen, dass die Form *O. Sloanei Sloanei* gar keine einheitliche systematische Einheit darstellt, sondern in sich mehrere verschiedene Formen beherbergt," I think may very likely prove to strike at the real crux of the matter. I have always been rather more inclined to split up the various Pacific races of *Ommastrephidæ* than most writers, yet it is now evident that the Japanese *O. pacificus* Steenstrup and apparently also the lately described *O. volatilis* Sasaki are perfectly distinct species, having far less relationship with the other Pacific forms than even I have formerly conceded (cf., in the case of *pacificus*, Berry, 1912, pp. 436-437 ; 1914, pp. 340-341).

Apparently the nearest known relative of *N. gouldi* of which we can be certain from the literature is Pfeffer's remarkable specimen from New Zealand, which he identifies with *Ommastrephes insignis* Gould, and by reason of which he erects the genus *Nototodarus* (Pfeffer, 1912, p. 434, pl. 31). Whether or not this specimen be actually the same as that described by Gould, its simpler hectocotylus indicates it to be sufficiently distinct from McCoy's species. Another interesting point to consider is the apparently close relationship evinced also by females of *N. gouldi* and my *Ommastrephes hawaiiensis* (Berry, 1912, pp. 434, 437 ; 1914, p. 338, text-fig. 38-39, pl. 54, fig. 2). The significance of this is, no doubt, that the discovery of males of *hawaiiensis* will necessitate its removal from *Ommastrephes* to *Nototodarus*. Although I no longer have any specimens of the latter species available for direct comparison, there appear to be certain small but constant characters sufficient to separate even female specimens from those of *N. gouldi*, notably the toothing of the horny rings. The rings of the larger sessile arm suckers (Fig. 24) are toothed all around with 19 to 21 teeth, occasional minute denticles appearing interpolated among the latter along the upper margin of the ring. The upper median tooth is much larger with respect to the other teeth than in the case of *N. gouldi*. The larger tentacular suckers (Fig.

25) show 13 to 16 acute teeth alternating with an equal number of thin, arcuate plates, here again the upper median tooth being conspicuously the largest. To better bring out these small differences I here append figures of horny rings from both a sessile arm and tentacle club of the type specimen (dorsal mantle length 138 mm.) of *O. hawaiiensis.* Figs. 17 and 19 show similar structures from a female specimen of *N. gouldi* of only slightly larger size (dorsal mantle length 180 mm.). Other differences in the two species worth noting are the relatively larger head of *hawaiiensis*, the apparently fewer and larger arm suckers, and the much shorter fins.

The radula of *N. gouldi* reminds one very much of that of *O. sloanii* as figured by Hutton (1882, pl. vi., fig. B). It is also surprisingly similar to that of *Ommastrephes sagittatus* as figured by Girard (1890, pl. —, fig. 3e), though not at all like those of the other genera of the family as he illustrates them. This bears out the evidence of other structural features that *Nototodarus* is exceedingly nearly allied to *Ommastrephes* s.s. and quite possibly to be regarded as a comparatively recently more highly specialised offshoot from the latter.

The small, round, thin transparent "window" in the integument of the ventral surface of the head covering the eye, so well shown in Pfeffer's figures of New Zealand *Ommastrephes sloanii* and other Ommastrephids, can be made out in the "Endeavour" specimens. Its probable function is a puzzle, but it puts one strongly in mind of the similarly situated transparent membrane which overlies the subocular photophores of *Watasenia*, *Enoploteuthis*, and allied genera, and permits the better escape of the light rays. On this slim ground I have made a careful search for subocular photogenic organs in *Nototodarus*, but have been unable to demonstrate their presence. On a more favourable occasion I hope by recourse to sectioning to settle the matter conclusively.

Division MYOPSIDA.

Family LOLIGINIDÆ.

Genus Loligo, *Schneider*, 1784.

Loligo etheridgei, *sp. nov.*

(Plates lxvii.-lxviii. ; Plate lxix., figs. 1-2.)

Animal of moderate size, of the characteristic *Loligo* outline. *Mantle* cylindrical in front, slightly swollen near the middle, thence tapering between the fins to a moderately acute point behind. *Fins* large, about three-fifths as long

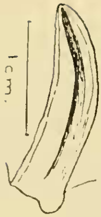

Fig. 28. — *Loligo etheridgei* ♂ [490], locking cartilage, from left side of funnel of paratype; camera outline.

as the mantle; sagittate; scarcely lobed in front, behind barely continuous above the posterior tip of the body; widest a little in front of the middle, the lateral margins obtusely angled. Anterior mantle margin projecting forward in nuchal region to a rounded angle, a similar but more acute projection on either side of the funnel. *Locking apparatus* well developed, the lateral cartilages (Fig. 28) relatively broad, with a wide central excavation.

Head small, narrower than the body, widest behind, where it is ornamented by a strong fold of the integument; distinctly tapering past the eyes to the point of junction with the arms. *Eyes* large, not protruding. *Funnel* stout, with dorsal bridles and a large terminal valve.

Arms stout, rather short; their formula of relative length, easily 3, 4, 2, 1; third pair decidedly the stoutest and longest, dorsal pair distinctly smallest and shortest, the others nearly equal; dorsal arms conspicuously keeled above; second

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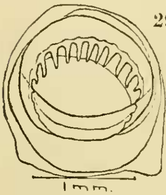

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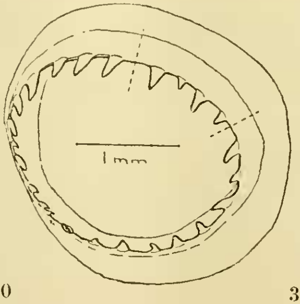

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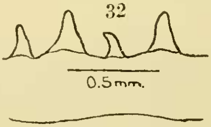

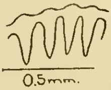

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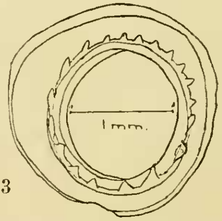

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Fig. 29.—*Loligo etheridgei* ♂ [489], horny ring of sucker of 7th-8th pair from base of right third arm of type; camera drawing from a mount in balsam.

Fig. 30.—Teeth from superior margin of same, seen in greater magnification.

Fig. 31.—Horny ring of eighth sucker from base of inner ventral row of left tentacle club of paratype [490]; camera drawing from a mount in balsam.

Fig. 32.—Portion of margin of same, seen in greater magnification.

Fig. 33.—Horny ring from one of the larger suckers of the ventro-marginal series on the left tentacle club of type [489]; camera drawing from a mount in balsam.

pair of squarish outline, the dorsal outer angle subcarinate, the lower keeled ; third pair roughly triangular, their conspicuous outer keels continuous with the tentacle sheaths and thus with the broad outer keel of the squarish ventral arms, the latter again keeled on their inner (*i.e.*, ventral aboral) margins. Trabeculated swimming membranes well developed on all the arms, especially the third, though quite narrow on the ventral pair. Suckers small, biserial, more or less kettle-shaped ; obliquely perched on short conical pedicels ; apertures notched at the apex ; horny ring (Figs. 29-30) armed along their superior margins with (in the largest) 12-13 very long, narrow, pointed teeth, reduced to rudiments on the sides and obsolete below. A large sucker from near the middle of the right third arm has a maximum diameter of 1.57 mm.

Left ventral arm of male *hectocotylized* (Pl. lxix., fig. 2), the proximal portion apparently normal for about three-fifths the total length, or about the first 17 pairs of suckers ; at this point suckers of ventral series becoming much reduced and the thickened bases of their pedicels very elongate, especially the first nine to suffer the modification ; first of these modified pedicels possessed of a small but unmistakable sucker with a well-developed horny ring, those following having their suckers reduced to tiny, knob-like swellings at their tips (Fig. 34) ; in dorsal series first 19 suckers unmodified, then giving way to stout, conical papillæ scarcely half as long as their mates of the opposite series (the second papilla, which is the longest of the ventral series, measures approximately 2.5 mm.), but like these having their suckers reduced to tiny swellings at their apices ; papillæ of both series regularly diminishing in size distally, not, so far as the present material shows, again giving way to normal suckers toward the extremity. *Umbrella* rudimentary, except for the usual tentacle sheath.

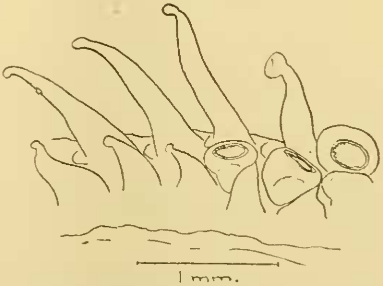

Fig. 34.—*Loligo etheridgei* ♂ [489], portion of hectocotylized arm of type, showing the commencement of the modified papillæ ; camera sketch.

Tentacles of moderate length ; *Tentacle club* (Pl. lxix., fig. 1) well expanded, bearing an outer keel broadened distally into a fleshy membrane, and a well developed trabeculated membrane bordering the sucker-bearing area; suckers bowl-shaped, numerous, in four rows, those of the two medina series on the expanded portion of the club half again as large as the corresponding suckers of the marginal series; suckers numbering about 12 in each series before the narrow distal part (the latter comprising less than one-third the length of the club) is reached, where those in all four series become very minute, those of the ventral series slightly the largest, the others diminishing slightly in size both distally and toward the dorsal margin; number of suckers in each row on this distal part of club about 25. Horny rings of larger central suckers of club armed (Figs. 31-32) with 21-26 acute well-separated, conical teeth, largest on the upper margin, but continuing around the entire circumference, the large and small teeth as a rule in regular alternation. One of the largest of these suckers has a maximum diameter of 2.88 mm. Horny rings of the larger marginal suckers (Fig. 33) with 19-22 acute, incurved teeth, smaller on the lower margin, but not clearly in alternating sizes. One of these marginal suckers measures 1.92 mm.

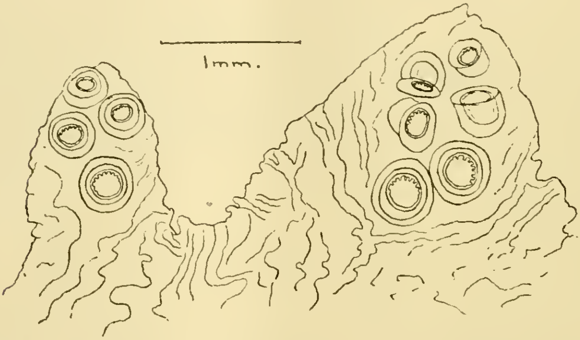

Fig. 35.—*Loligo etheridgei* ♂ [490], two ventral lappets of right side of buccal membrane of paratype; camera drawing from a mount in balsam.

Buccal membrane 7-pointed, each point bearing from 4 to 7 minute, biserially arranged suckers (Fig. 35), their horny rings toothed along the upper margin with about 8 square-pointed teeth. The largest of the suckers shown in the drawing has a maximum diameter of exactly .5 mm.

Mandibles shown in Fig. 37.

Radula (Fig. 38*) showing rhachidian teeth each with large conical, down-curved, central cusps and a small, triangular, marginal cusp on each side; first laterals with large, conical, central cusps and a small, conical cusp on the outer margin, the inner margin more or less produced but not cusped, so that they much resemble broken rhachidian teeth in shape as well as in size if allowance be made for the "break"; second laterals larger, comprising a broad, rapidly tapering knife-like blade, springing from a base shaped like an inverted chapeau; marginals with inconspicuous bases, but their slender, talon-shaped blades largest of all.

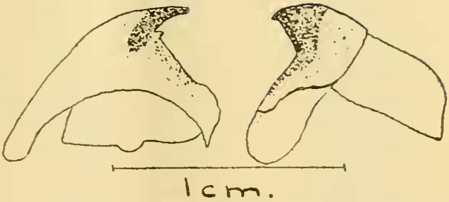

Fig. 36.– *Loligo etheridgei* ♂ [490], part camera drawing of mandibles.

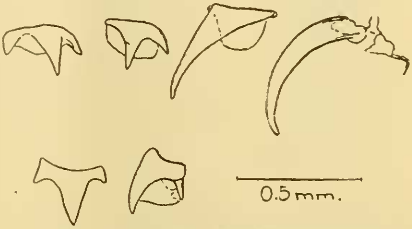

Fig. 37.—*Loligo etheridgei* ♂ [490], teeth of one side of one row of radula of paratype; camera drawing from a mount in balsam. Additional views given below of a rhachidian and first lateral tooth.

Gladius† (Fig. 36) strongly convex, the wings relatively compressed toward one another, so that in situ the outline appears much narrower than shown in the figure; anterior projection of rhachis relatively short and wide, tapering rapidly between the wings which originate from it rather abruptly; wings with a strong thickening for most of their length, but this is not marginal; midrib much darker than remaining portions.

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*Unfortunately, in the specimen chosen for mounting the margins of the radula were so much curled inward that it had to be more or less torn apart before it could be drawn. As a consequence it is not certain that all the teeth shown in the figure belong in exactly the same transverse series, though all are taken from that region of the organ where the teeth are best developed and from as nearly the same horizontal level as possible.

†The gladius of the type, which is that described, was found to be badly broken. That of the paratype had been removed before the specimen came into my hands.

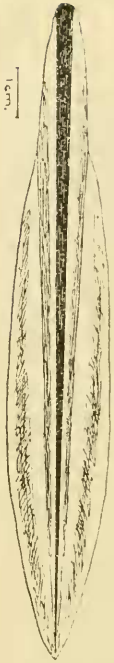


Fig. 38. — *Loligo etheridgei* ♂ [489], reconstructed drawing of gladius of type, represented with wings pressed flat.

Color in alcohol or formalin brownish with iridescent or metallic patches; chromatophores (most numerous along the medio-dorsal line) reddish brown.

Type.—A ♂, E6068 [S.S.B.489], in the collection of the Australian Museum, Sydney. A paratype [S.S.B. 490] has been retained by the writer.

Type Locality.—"Australian Seas (? S. E.)"; ("Endeavour"); 2♂♂.

Remarks.—It is rather a gamble to describe an Australian *Loligo* until someone having access to the British Museum collections can enlighten us as to what Gray's *L. australis* really is. The original description is not only meagre, but is sufficiently broad in terms to apply about equally well to either of the two or three Australian species of the genus which I have before me at this writing. Fortunately one of these is a specimen from Port Jackson [S.S.B. 488], sent me by Mr. Hedley with a note stating that it was identified at the British Museum as *L. australis* Gray. Assuming the correctness of the determination, *australis* must be regarded as altogether different from the "Endeavour" species.

In size and the general outline of its body, *L. etheridgei* recalls Pfeffer's figures of *L. indica*, but differs in the somewhat larger fins and different dentition of the horny rings, more especially those of the sessile arms, which in *L. indica* are said to be squared ("viereckigen") and only about six in number, though comparison should be made with the notes given by Massy (1916, p. 218-221). Its type locality is Java. I agree with Goodrich (1896, p. 7) that a serious discrepancy exists between the specimens taken by the "Challenger" in the Arafura Sea, as illustrated by Hoyle, and the original description by Pfeffer.

L. edulis, Hoyle, is a stouter, more robust species. The horny rings of its sessile arm suckers are long, but are described as square-cut and but eight in number. Those of the larger tentacular suckers are said to bear about 20 large teeth, with nearly as many smaller ones in alternation.

Measurements :

TABLE XII.—MEASUREMENTS OF *Loligo etheridgei.*

Author's Register Number	[489]	[490]
	Type.	Paratype
Sex	♂	♂
	mm.	mm.
Total length	265	263
Length of body, dorsal	132	143
Tip of body to base of dorsal arms	148	165
Length of fins, extreme	80	85
Width of body	30	29
Width across fins	73	70
Width of head across eyes	23	22
Length of head	18	20
Length of funnel (median)	20	23
Length of right dorsal arm	32	33
Length of left dorsal arm	34	34
Length of right second arm	37	43
Length of left second arm	40	44
Length of right third arm	47	65
Length of left third arm	47	55
Length of right ventral arm	42	46
Length of left ventral arm	44	46
Length of hectocotylus	18	19
Length of right tentacle	120	92
Length of right tentacle club	35	39
Length of left tentacle	98	103
Length of left tentacle club	35	39

Genus SEPIOTEUTHIS, *de Blainville* 1824.

SEPIOTEUTHIS AUSTRALIS, *Quoy and Gaimard* 1833.

1833. *Sepioteuthis australis*, Quoy and Gaimard—Zool. Voy. "Astrolabe," t.2, p. 77, pl. 4, fig. 1.

1839. *Sepioteuthis australis*, d'Orbigny, in d'Orbigny and Férussac—Céph. acét., p. 300, Sepiot., pl. 5, fig. 5 ; pl. 6, figs. 15-21.

1845. *Sepioteuthis australis*, d'Orbigny—Moll. viv. et foss., p. 324, pl. 17, fig. 15.

1849. *Sepioteuthis australis*, Gray—Ceph. Brit. Mus., p. 79.

1879. *Sepioteuthis australis*, Tryon—Man. Conch., v. 1, p. 151, pl. 61, figs. 201-205.

1883. *Sepioteuthis australis*, McCoy—Prodr. Zool. Victoria, Dec. 8, p. 5, 27, pls. 76-77.

1889. *Sepioteuthis australis*, von Martens—Forsch. Gazelle, III, p. 191 (*fide* Hedley).

1892. *Sepioteuthis australis*, Brazier—Cat. Ceph. Austr., p. 14.

1913. *Sepioteuthis australis*, Wülker—Ceph. Aru und Kei Ins., p. 461, 462, 463, **470, 482,** 485.

1916. *Sepioteuthis australis*, Hedley—Journ. Roy. Soc. W. Austr., v. 1, p. 21 (merely catalogued).

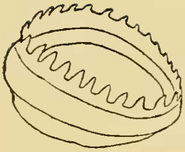
Recorded Distribution.—Darnley Island, Torres Strait (Gray); Port Jackson, New South Wales (Gray); Western Port, Victoria (Quoy and Gaimard); Port Phillip, Victoria (McCoy); Mermaid Straits, Western Australia (von Martens).

Material Examined.—1 ♀, E6064 [S.S.B. 509]; "Australian Seas (? S E.)"

Measurements.—

TABLE XIII.—MEASUREMENTS OF *Sepioteuthis australis.*

Author's Register Number	[509]
Sex	♀
	mm.
Total length	505
Length of body, dorsal	265
Length of body, ventral	238
Tip of body to base of dorsal arms	295
Width of fin at widest point	54
Width across fins, at widest part near middle	170
Width of body in same region	64
Width of body at anterior third	70
Length of head	37
Length of funnel, median	47
Length of right dorsal arm	71
Length of left dorsal arm	73
Length of right second arm	92
Length of left second arm	91
Length of right third arm.	104+
Length of left third arm	108
Length of right ventral arm	111
Length of left ventral arm	111
Length of right tentacle	196
Length of right tentacle club	81
Length of left tentacle	209
Length of left tentacle club	84



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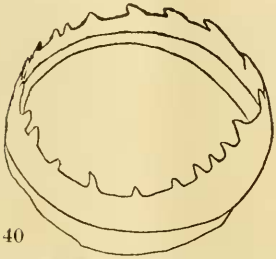

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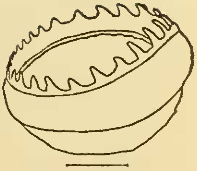

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Fig. 39.—*Sepioteuthis australis* ♀ [509], horny ring of fifth sucker from base in ventral series of right third arm; camera drawing from a mount in balsam.

Fig. 40.—Horny ring of large sucker from middle of tentacle club of same specimen; same scale.

Fig. 41.—Horny ring of marginal sucker from middle region of tentacle club of same specimen; same scale.

Remarks.—Although apparently not thoroughly typical, the single specimen of this genus in the "Endeavour" collection seems referable to the long known but still not very common *S. australis.* It possesses the broad, oval fins, widest near the middle of the sharply tapering body, and the plain colouring characteristic of preserved specimens of this species, but it differs from the descriptions given by d'Orbigny and McCoy in that the ventral arms are distinctly longest, the formula being 4, 3, 2, 1, instead of 3, 4=2, 1. Their examples were also considerably larger, and there are a few minor specifications in which their descriptions and the "Endeavour" specimen fail to tally. It should further be noted for the latter that the horny rings of the suckers of the sessile arms are scarcely "trés-obtuses," as stated by d'Orbigny (1845, p. 324). Some of these discrepancies may later on prove of greater consequence than can be shown now.

A horny ring of a diameter of 2.7 mm. from one of the largest suckers (fifth from base) of the third right arm (Fig. 39) shows 27 sharp, conical teeth placed fairly closely. A ring from a lateral sucker from the central portion of the tentacle club (Fig. 41) is quite similar, but has only 24 teeth, which are a little longer, narrower, and more widely spaced than those of the sessile arm rings. This ring measures 3.3 mm. in diameter. Rings from two of the largest median suckers of the tentacle club show respectively 22 (Fig. 40) and 26 pointed, conical teeth, with relatively wide interspaces. They measure 4.3 and 4.6 mm. in diameter.

The dorsal lappet of the buccal membrane shows 5 suckers, the next pair of lappets 5 each, the succeeding pair 6 each, the right ventral 2, and the left ventral 3. One of the largest

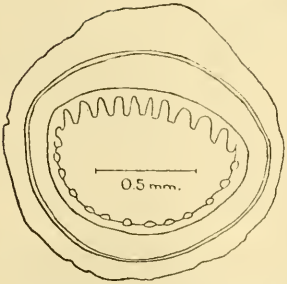


Fig. 42.—*Sepioteuthis australis* ♀ [509], horny ring of basalmost sucker from third right lappet of buccal membrane; camera drawing from a mount in balsam.

suckers from the lower lappet measures 1.36 mm. in diameter. Its ring (Fig. 42) is armed with 24 teeth, which are long, narrow, and tapering on the superior margin, though with rather truncate points, becoming, on the inferior margin, smaller, stouter, and more pointed. A curious, stiff, transversely ridged, tongue-shaped pad lies in the folds of membrane between the ventral lappets. I do not remember having noticed mention in the literature of any structure of this sort. From its position and appearance one would naturally infer an homology with the similarly situated "spermatic pad" of the female *Sepia*. The extremity of the left ventral arm lacks most of its suckers and at first glance much resembles certain forms of hectocotylus, but since a few minute suckers persist near the tip, whilst the extremity of the left third arm is similarly affected, I take it that the specimen is simply a normal ♀ which has suffered abrasion of some of its suckers.

Family SEPIOLIDÆ

Subfamily ROSSIINÆ.

Genus Rossia, *Owen*, 1834.

Subgenus Austrorossia, *nov.*

Characters of subgenus so far as known those of typical *Rossia* except—

(1) The tentacle club is unusually long, more or less coiled, and armed with an immense multitude of infinitesimal suckers.

(2) The suckers on the sessile arms are in two rows throughout.

(3) Some of the suckers on all the sessile arms of the ♂ suffer sexual modification, *i.e.*, enlargement.

(4) The hectocotylised arms of the ♂ are characterised not only by modifications in the size of certain of the suckers as above, but (in the type species at least) by the presence of a pocket-like gland on the outer surface of the arm.*

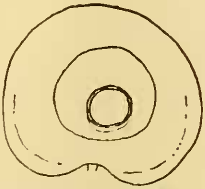
Type.—The following species :—

Rossia (Austrossia) australis, *sp. nov.*

(Plate lxix., fig. 3-4 ; plate lxx.)

Body smooth, sepioliform, moderate in size ; mantle widest sometimes in the middle, sometimes in front, thence tapering to a rounded or round-pointed extremity. *Fins* relatively large, attached well in front of the middle of the body ; maximum length 75-90% that of the mantle, length along line of attachment to body 56-66% the mantle length ; in outline semicircular, evenly arcuate ; anterior lobes conspicuous, sometimes exceeding the mantle in front ; posterior margins scarcely if at all indented where they join the body. Mantle margin showing a slight nuchal sinuosity; it articulates with the head by the usual nuchal cartilage (Pl. lxx., fig. 3) and a pair of large, oval, very deeply grooved funnel cartilages (Pl. lxx., fig. 4).

Head large, distinctly wider than the body. *Eyes* large and prominent, their lower lids free. *Funnel* large, reaching to a point a little past the centre of the eyes; interior capacious, a small flap-like valve near the apex ; *Funnel organ* (Pl. lxx., fig. 8) comprising the usual large, hepatiform, dorsal organ and a pair of ovate, ventro-lateral pads about two-thirds the length of the former, the dorsal organ terminating in a slender, sharp-pointed, median papilla in front.



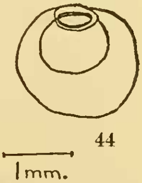


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Fig. 43.—*Rossia australis* ♂ [538], large sucker from lateral arm of type ; camera drawing from a mount in balsam.

Fig. 44.—*Rossia australis* ♀ [539], sucker from near middle of third arm of paratype ; camera drawing from a mount in balsam.

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*Pfeffer (1908, p. 32) describes the sexual differences in *Rossia* s.s. as follows (translation) :—

"The dimorphism of the sexes is expressed by the suckers of the 2nd, 3rd, and 4th arm pairs, or sometimes (in those species with 4 rows) the suckers of the outer rows of the same arm pairs, being more or less greatly enlarged. Further in the true hectocotylization, which consists in the basal cushions of the suckers of the outer rows on both arms of the 1st pair for the proximal three-fifths of their length being somewhat elongated, pressed together, and thus bringing about a pectinated appearance of that part of the lateral surface of the arm ; the entire structure is more or less covered by a true protective membrane (Schutzsaum), which otherwise is almost entirely foreign to the family Sepiolidæ."

Sessile arms rather short, the relative order of length usually 3, 2, 4, 1, though subject to some variation ; lateral pairs, however, consistently rather longer than the dorsal and ventral pairs, being as long as or a little longer than the body ; traces of keels present on the outer aspects of the three dorsal arm pairs, but conspicuous only on the third pair. *Suckers* nearly spherical, in two rows throughout ; apertures very minute ; horny rings smooth ; in the ♀ (Pl. lxx., fig. 6 ; Fig. 44) suckers similar on all the arms, smaller near the base, fairly large along the middle, and gradually smaller again toward the extremity. In the ♂ both dorsal arms *hectocotylised* (Pl. lxix., figs. 3-4 ; Pl. lxx., fig. 5), and in similar fashion ; basal 6 or 8 pairs of suckers exceedingly small ; these followed by perhaps half-a-dozen pairs of suddenly much larger suckers, which are not, however, so large as those of corresponding position on the other arms in this sex ; suckers toward tip of arms gradually diminishing in size ; in all about 25 pairs readily numerable on each arm without a lens ; outer (ventral) face of each arm of this pair equipped with a slightly swollen, pocket-like organ (Pl. lxix., fig. 3), consisting of soft, spongy, colourless tissue of an apparently glandular nature, and borne opposite the 6th-9th suckers of the ventral row ; a little above the middle of the organ a deep, longitudinal groove ; a deeper pocket present between the margin of the gland and the sucker-bearing face of the arm. Suckers on the main portion of the remaining arms of the ♂ (Pl. lxix., fig. 4) greatly crowded and enlarged (Fig. 43) over the condition seen in the ♀, those of the ventral series of the lateral arms appearing a trifle larger than the others. *Umbrella*, except for the well developed tentacular sheath, rudimentary.

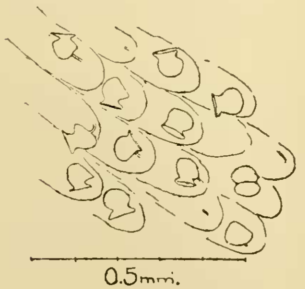

Fig. 45.—*Rossia australis* ♀ [539] portion of oral face of left tentacle club, highly magnified ; part camera drawing from a mount in balsam.

Tentacles long, slender, varying from two and one-half to over three times the mantle length ; in section sub-triangular, the inner face sharply defined, excavated, and marked by a conspicuous central groove. Tentacle *Club* (Pl. lxx., fig. 7) elongate, comprising more than one-fourth the total length of the tentacle ; not expanded, but tapering for the most part very gradually, then more suddenly to the extremity ; usually more or less strongly coiled upon itself ; equipped along its entire length with a narrow dorsal membrane or keel, which is widest at about the proximal third, then gradually narrows to the tip, while proximally it extends for a considerable distance below the suckers; proximal one-sixth to one-seventh of the club, reckoning the latter as co-extensive with the dorsal keel, bare; for the remainder of its length covered on the oral aspect with a great number of excessively minute suckers so small as to appear to the eye or even under weak magnifications as a mere velvety pilosity.

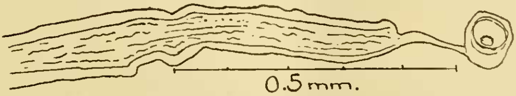

Fig. 46.—*Rossia australis* ♀ [539], isolated sucker and pedicel from central portion of left tentacle club; camera drawing from a mount in balsam.

Under higher power suckers seem to be borne on long, slender pedicels, only loosely crowded; mostly with a diameter of about 0.075 mm., but a few measuring as much as 0.09 mm., and one noted to have a diameter of 0.11 mm., though this last may have been somewhat crushed by its cover glass; counting uncertain, but about 50 apparently numerable in a transection of the club near its centre (Figs. 45-46). Under favorable light and relatively high power (170 diam.) horny rings apparently toothed with very small, acute sharp teeth for at least half their circumference, but whether these are true teeth and not merely projecting papillæ from the papillose area, I cannot be certain.

Gladius slender, lanceolate, shorter than the body.*

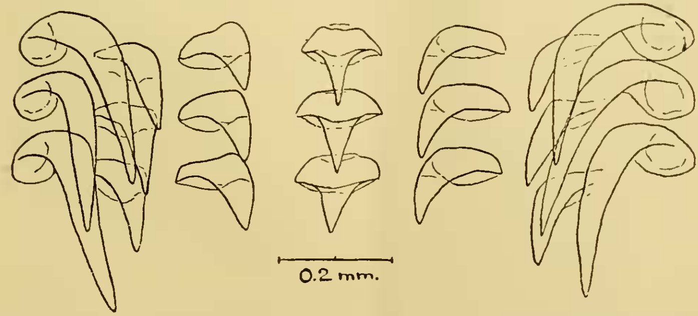

Fig. 47.—*Rossia australis* ♀ [540], three rows of teeth from radula; camera drawing from a mount in balsam.

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*In the specimen dissected the gladius was found too badly broken for figuring.

Radula (Fig. 47) with seven rows of teeth of simple structure, rhachidian teeth with short, stout, acutely conical points springing from cap-shaped bases; first laterals a little longer; second laterals still longer and relatively more slender; marginals strongly arcuate, bending sharply downward, their scimitar-like blades nearly twice as long as those of the second laterals.

Surface, except for slight wrinkles due more or less directly to the action of the preserving fluid, apparently everywhere smooth

Color of specimens preserved in formalin a greyish buff, copiously sprinkled above and below with chromatophores of several shades of reddish brown; strongly tinged with violet on the dorsum, above the eyes, and near the tips of the arms; arms, pupils of the eyes, and certain other regions opalescent; lower part of eyeball within the lower lid with a strongly metallic, golden iridescence.

Measurements.—

TABLE XIV.—MEASUREMENTS OF *Rossia australis.*

Author's Register Number.	[538]	[539]	[537]	[540]	[541
	Type.	Paratype	Paratype		
Sex	♂	♀	♀	♀	♀
	mm.	mm.	mm.	mm.	mm.
Total length	120	230	230	145	..
Length of body, dorsal	32	50	50	34	30
Length of body, ventral	30	48	46	31	26
Tip of body to base of dorsal arms	50	73	67	45	50
Length of fin	27	38	37	29	28
Length of fin at point of attachment	20	30	28	20	20
Width of fin at widest point	14	20	18	15	12
Width across fins	50	75	72	52	48
Width of body	21	36	33	25	24
Depth of body	18	26	22	17	15
Width of head across eyes	25	32	31	27	23
Length of head	19	25	22	17	20
Length of funnel, median	13	20	18	15	13
Length of right dorsal arm	30	36	37	30	27
Length of left dorsal arm	30	38	38	30	29
Length of right second arm	36	41	40	30	..
Length of left second arm	36	45	40	34	29
Length of right third arm	38	45	38+	34	34
Length of left third arm	38	45	39	32	34
Length of right ventral arm	35	39	36	28	28
Length of left ventral arm	34	39	34	29	..
Length of right tentacle	75	150	168	90	..
Length of right tentacle club*	22	42	38	27	..
Length of left tentacle	81	123	135	95	..
Length of left tentacle club*	21	44	37	32	..

* Measured from beginning of dorsal membrane.

Type.—A ♂, E3636 [S.S.B. 538], in the collection of the Australian Museum, Sydney. A paratype [S.S.B. 537] has been retained by the writer.

Type Locality.—250-300 fathoms, long. 130° 50′ E., Great Australian Bight, south of Eucla, Western Australia; ("Endeavour"); 1 ♂, 2 ♀ ♀.

Recorded Distribution.—175-300 fathoms, Great Australian Bight; 200-250 fathoms, Gabo Island to Everard Grounds, Victoria.

Material Examined.—

TABLE XV.

No. of Speci-mens.	Sex.	Depth in Fathoms.	Locality.	Original Number.	Author's Register	Remarks.
1	♀	250-300	Long. 130° 50′ E., Great Australian Bight, S. of Eucla, W.A.	E3635	[537]	Paratype
1	♂	,,	,,	E3636	[538]	Type
1	♀	,,	,,	E3637	[539]	Paratype
1	♀	175	Long. 128° 40′ E., Great Australian Bight, S.W. × S. of Eucla, W.A.	E4376	[540]	
1	♀	200-250	Gabo Island to Everard Grounds, Victoria.	E5724	[541]	

Remarks.—This attractive Sepiolid is of interest in being only the second member of its genus to be recorded from the Southern Hemisphere. It has no near affinity with any of the northern forms, but on the other hand is so closely similar to the lately described East African *R. mastigophora*, Chun, that at first glance I thought the two might prove specifically identical. This, however, was not borne out by more detailed study. No doubt with our present knowledge females alone of these species would be very hard, even though not impossible, to separate. Fortunately in the hectocotylized arms of the male we find structures subject to unusually definite specific modification, so that we would seem quite safe in relying on them. The recent careful studies of Naef on the Mediterranean Sepiolids, supported by my own less extended (though only partly published) investigations of *Euprymna*, indicate that in this family as much or more than in other cephalopods even relatively minor details in the morphology of these organs have considerable taxonomic significance. Here we find some very tangible differences between the two species.

Chun, in his illustrations of *R. mastigophora*, figures the dorsal arms as showing conspicuously enlarged suckers on the inner (dorsal) series only. He shows only three or four pairs of the minute basal suckers, and neither describes nor illustrates the lateral pockets which are so curiously developed in *R. australis*. That his specimen could not have been too immature to exhibit these features is shown by the fact that in gross measurements (*e.g.*, mantle length 31 mm.) it almost exactly tallies with the example before us. Another interesting difference is that in his specimen the right dorsal arm was decidedly longer (29 mm.) than the left (25 mm.). Still another difference noted between the present species and *R. mastigophora* is in the notably smaller size (and probably greater number) of the tentacle suckers. Chun (1915, p. 407) writes as follows :—

"Die Tentakelnäpfe sind so winzig, dass sie mit blossem Auge kaum erkannt werden können. Die Ausmessung ergibt, dass sie einen Querdurchmesser von nur 0, 15-0, 17 mm. aufweisen und damit zu den kleinsten Tentakelnäpfen gehören, die wir überhaupt aus der Reihe der Decapoden kennen."

Nevertheless suckers from a ♀ *australis* larger than Chun's largest specimen average a diameter less than half that cited by him. They must indeed rank among the most minute, fully functioning, true suckers known.

The farther I have been able to push the comparison, the more sharply differentiated from one another the northern and southern *Rossiæ* appear to be. The subgeneric distinction here proposed between them seems but the logical step to take. I shall not be greatly surprised in case a full anatomical investigation requires the elevation of *Austrorossia* to full generic rank. At present the most important differences are naturally to be found in the hectocotylized arms, which, in the two austral species, are constructed on an altogether different plan than in such species as *R. glaucopis* (Lovén), *R. mölleri* Steenstrup, or *R. pacifica* Berry.

Family SEPIIDÆ.

Genus Sepia, *Linnaeus*, 1758.

Sepia hedleyi, *sp. nov.*

(Plates lxxi.-lxxii.)

Animal rather small ; *Body* of only moderate width, the widest central portion only slightly exceeding the anterior region, but tapering rapidly to a point behind ; anterior margin of mantle with a broad, conspicuous, dorsal rostrum; ventral margin evenly emarginate below the funnel. *Fins* long, narrow, their attachment not quite reaching either the tip of the body or the anterior mantle margin, though both these points surpassed by the posterior and anterior lobes of the fins themselves. *Funnel* large, deeply immersed, its apex reaching some three-quarters of the distance from its hinder margin (or a little better than half-way from the mantle margin) to the cleft between the ventral arms; interior with a semicircular, flap-like valve; funnel organ indistinguishable in specimen examined.

Head distinctly narrower than body. *Eyes* large, prominent.

Sessile arms rather short; ventral pair usually distinctly the largest and longest, the others varying, but in general subequal, from one-fourth to one-third the mantle length. *Umbrella* better developed in some specimens than others, but never extending between arms for more than one-third their length; absent between ventral pair. Suckers of arms crowded; ostensibly in four rows, those of the inner series notably larger than the marginal; individual suckers (Fig. 48) bowl-shaped, the largest measuring about 1 mm. in maximum diameter, notched above, their outer periphery beautifully fluted; horny rings swollen, not dentate, but with very weakly crenate margins.

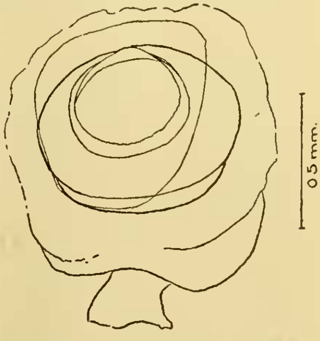

Fig. 48.—*Sepia hedleyi* ♂ [499], one of the larger suckers from right third arm of type; camera drawing from a mount in balsam.

Left ventral arm *hectocotylized* (Pl. lxxii., fig. 6); basal third of arm normal, the suckers in 4 series, or better described (as is plainly indicated by the subsequent structure of the arm) as two strongly zig-zag rows, with the inwardly displaced members distinctly larger than the outer ones, much as already noted for the suckers of the remaining arms; according to this interpretation, the dorsal of the two basalmost suckers inwardly displaced, the ventral outwardly, both being relatively small like the succeeding marginal suckers; suckers thence regularly zigzagging as described until 11 pairs are accounted for, the flattened sucker-bearing area first widening, then narrowing, so that in this general region this area is elongate-oval in outline ; 13th sucker of dorsal series smaller than its predecessors, the 14th very conspicuously reduced and followed by 14 excessively minute suckers, normally zigzag in position, but becoming largely, by reason of their reduction in size, relatively distant from one another ; 29th and 30th suckers of this row suddenly larger, the remaining suckers to the extremity of the arm appearing normal in every particular ; in the ventral series, 12th sucker not only smaller than its predecessor, but also *marginal*, being succeeded by 17 very minute suckers in single file similar to those of the zigzag dorsal series, but a trifle larger, and elevated from the dorsal portion of the sucker bearing face of the arm by a narrow ridge ; 30th sucker of ventral series somewhat larger, 31st still larger, 32nd again larger as well as inwardly displaced ; beginning with 31st sucker members of this series normal in size and zigzag arrangement, so that the usual 4-rowed appearance prevails on this portion of the arm ; central portion of face of arm where reduced suckers are borne conspicuously narrowed, again expanding with the recommencement of the normal suckers.*

Tentacles relatively short (two-thirds the length of the body), stout, in section rounded-triangular with a somewhat flattened inner face ; *club* (Pl. lxxii., figs. 3-4) expanded, semilunar in outline, its inner face flattened and armed with excessively numerous, minute, crowded suckers, *slightly* and evenly graduated in size, near the centre of the club seeming to comprise about 12 series. Suckers of club (Fig. 49) deeply basin-shaped, having a wide, nearly circular papillary area and relatively small apertures ; diameter of an average sucker on middle portion of club 0.3 mm. ; horny rings armed all around with possibly 18-22 excessively minute, pointed teeth, so small that exact number cannot be stated surely with present facilities ; two suckers larger than remainder just within the curious pocket-like flap crowning the apex of the club (Pl. lxxii., fig. 5), one of them being the terminal sucker on the ordinary sucker-bearing face of the club, the other springing directly from near the middle of the otherwise suckerless dorsal membrane. Sucker-bearing area of club furnished with a delicate marginal membrane; basal outer angle of club with a strong membranous keel.

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* To avoid possible confusion the description of the hectocotylus has been drawn throughout from one specimen, the type. Other males examined show certain divergencies, chiefly in the way of slight variations in the numbers of suckers occupying the respective regions of the arm and so on. The modified suckers of the ventral row sometimes show traces of the original zigzag arrangement, while in one specimen the uniserial arrangement nowhere prevails. In none of the specimens, however, does the lateral displacement of these suckers equal that of those opposite them in the dorsal series.

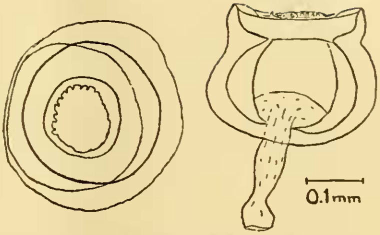


Fig. 49.—*Sepia hedleyi* ♂ [499], two suckers from right tentacle club of type; camera drawing from a mount in balsam.

Gladius (sepiostaire) absent or fragmentary in all specimens seen (see reconstruction in Pl. lxxii., fig. 2); chitinous margin and striated area relatively large; locular index about 25 or 26.

Radula (Fig. 50.) offering no very remarkable features; similar to that of the following species except that the falcate third laterals or marginals are not so long relatively to the other teeth and the rhachidians are a trifle smaller or at least no larger than the first laterals, although the last feature may depend somewhat upon their level in the radula.

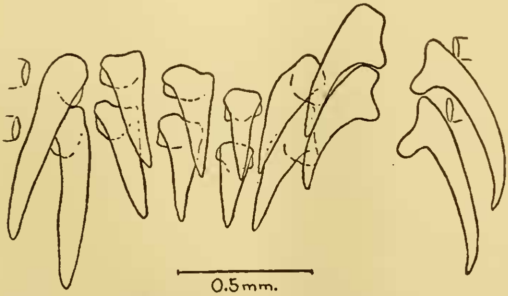


Fig. 50.—*Sepia hedleyi* ♂ [502], two rows of teeth from radula of paratype; camera drawing from a mount in balsam.

Surface nearly smooth or ornamented above by numerous very low, faint, scattered papillæ; on each side just above and parallel to the fins a series of perhaps six low, narrow, integumentary ridges.

Measurements.—

TABLE XVI.—MEASUREMENTS OF *Sepia hedleyi.*

Author's Register Number	[497]	[499]	[502]	[503]	[500]	[507]	[506]	[495]
	Paratype	Type	Paratype	Paratype				
Sex	♂	♂	♂	♂	♀	♀	♀	♀
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Total length	150	142	200	125	180	..	150	142
Length of body, dorsal	83	81	79	74	98	91	86	86
Length of body, ventral	70	73	74	63	78	81	76	76
Tip of body to base of dorsal arms	90	87	95	80	103	101	99	95
Width of fin at widest point	6	8	8	7	9	12	10	10
Width across fins	..	50	56	45	..	60	66	56
Width of body	41	35	41	31	44	38	46	38
Depth of body	23.1	23.5	21	21.4	28	26.5	24.2	27.5
Width of head across eyes	29	30	32	25	31	38	37	31
Length of head (nuchal cartilage to base of dorsal arms)	15	16	19	13	19	17	22	15
Length of funnel, median	27	23	32	21	28	25	23	27
Length of right dorsal arm	21	24	44	20+	28+	28	30+	28
Length of left dorsal arm	22	24	39	22	30	29	34	30
Length of right second arm	22	21	34	22	27	26	32	26
Length of left second arm	22	21	36	21	27	26	31	29
Length of right third arm	25	24	35	22	30	26	33	27
Length of left third arm	24	24	34	22	30	26	33	29
Length of right ventral arm	31	30	43	25	34	28	37	34
Length of left ventral arm	32	30	43	25	34	29	36	32
Length of right tentacle	55	33	99	49	80	..	52	48
Length of right tentacle club	10	8	13	11	13	..	12	11
Length of left tentacle	62	55	..	..	79	..	..	49
Length of left tentacle club	10	9	..	..	13	..	..	11

Type.—A ♂, E2464 [S.S.B. 497], in the collection of the Australian Museum, Sydney. A paratype [S.S.B. 497] has been retained by the writer.

Type Locality.—Investigator St. Area, south of Kangaroo Island, South Australia ; (" Endeavour ") ; 4♂♂.

Recorded Distribution.—80-175 (450 ?) fathoms, Great Australian Bight ; off coast of South Australia.

Material Examined.—

TABLE XVII.

No. of Specimens.	Sex.	Depth in Fathoms	Locality.	Original Number.	Author's Register	Remarks.
1	♂	..	Investigator St. Area, S. of Kangaroo Isd., S.A.	E2461	[497]	Paratype
1	♂	..	,,	E2462	[503]	Paratype
1	♂	..	,,	E2463	[502]	Paratype
1	♂	..	,,	E2464	[499]	Type
?1	♀	80-120	Great Australian Bight	E2455	[491]	
1	♀	,,	,,	E2456	[504]	
1	♀	,,	,,	E2457	[500]	
1	♂	,,	,,	E2458	[501]	
1	♀	,,	Long. 129° 28′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3619	[495]	
1	♀	,,	,,	E3620	[498]	
1	♂	,,	,,	E3623	[505]	
?1	?	350-450	Great Australian Bight, S. of Eucla, W.A.	E3609	[508]	doubtful
1	♀	175	Long. 128° 40′ E., Gt. Australian Bight, S.W. × S. of Eucla, W.A.	E4377	[507]	
1	♀	,,	,,	E4378	[496]	
1	♀	,,	,,	E4379(?)	[506]	

Remarks.—This, the most abundant *Sepia* in the " Endeavour " collection, is a rather small, neat-appearing species, which an exhaustive search of the literature has not enabled me to identify with any previously described cuttlefish, either from the Australian region or elsewhere. In the possession of numerous small equal-sized suckers on the tentacle club it reminds one of the species to be next described, but in other respects is abundantly distinct. In the male the peculiar hectocotylus furnishes a striking and easy means of identification.

Recognisable fragments of the sepiostaire could be secured from only one ♀ out of all the specimens seen, and even here they were scarcely in condition for description or satisfactory illustration. Because of the peculiar interest of the structure to the systematist or to the beach collector, however, the artist has done the best possible to reconstruct a characteristic figure, and, except possibly for the posterior region, has given a sufficiently true interpretation so that "bones" of the species should not go unrecognised.

Specimen E2455 I at first classified offhand with *S. dannevigi*, but am now inclined to think it merely a more than usually short and wide *hedleyi*. Specimen E3609, from deeper water by far than any of the others, is even more doubtfully identified.

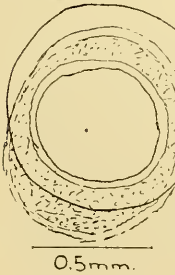
The body of one specimen [S.S.B. 507] shows considerable trace of colour in places—the grayish ground color being overlaid with an iridescent blue, showing tints of green, the whole spotted and mottled with warm sienna brown.

The species is gratefully dedicated to that master student of Australian Mollusca, Mr. Charles Hedley.

SEPIA DANNEVIGI, *sp. nov.*

(Plate lxiii; Plate lxxiv., figs. 1-2.)

Body rather wide and short, much flattened dorso-ventrally; breadth about 66% of the length, the widest point at about the anterior third; mantle margin with a broad, conspicuous, dorsal rostrum and a slight emargination below the funnel. *Fins* narrow, not quite reaching either the mantle margin or the posterior tip of the body. *Funnel* moderately long, reaching about two-thirds the distance from its posterior margin to the cleft between the ventral arms; interior furnished with a conspicuous, flap-like valve. Funnel organ not sufficiently distinguishable for description in specimen opened.



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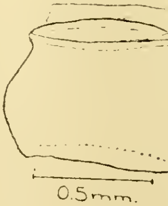

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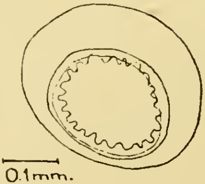

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Fig. 51.—*Sepia dannevigi* ♀ [493], horny ring of one of the largest suckers (4th-5th series from base) of right third arm of type, oral aspect showing papillary corona; camera drawing from a mount in balsam.

Fig. 52.—Horny ring of similar sucker from same specimen, lateral view, showing portion of papillary corona; camera drawing from a mount in balsam.

Fig. 53.—Horny ring from sucker of right tentacle club [494]; camera drawing from a mount in balsam.

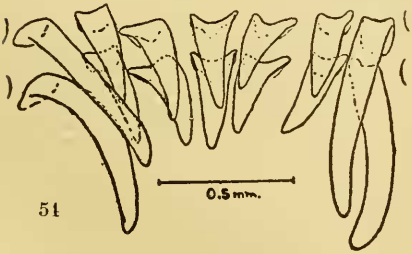
Head broad, its width varying proportionally to that of the body from as 2 : 3 to as 1 : 1. *Eyes* large.

Arms rather short, their formula 4, 3, 2, 1 ; ventral pair notably the largest and longest, attaining nearly two-thirds the mantle length, the others averaging about one-half the mantle length, exact proportions varying with the preservation. Suckers in four rows throughout ; horny rings smooth (Figs. 51-52), though sometimes weakly indented or crenulate along at least the superior margin, not truly toothed ; diameter of one of the larger suckers of left third arm of type 1.06 mm.

Tentacles triangular in section ; when expanded half as long again as the body ; *club* (Pl. lxxiv., fig. 2) small and flattened, comprising about one-eighth of the entire length of the tentacle ; suckers excessively numerous and minute, in perhaps 10-12 longitudinal series at the middle of the club, the horny rings (Fig. 53) distinctly toothed all around with about 20-22 rather blunt, minute teeth ; major diameter of one of largest suckers .37 mm. of its horny ring (that figured) .32 mm.

Gladius (sepiostaire) unknown.

Radula (Figs. 54-55) with simple rhachidian and first and second lateral teeth ; marginals falcate, their blades over twice as long as those of the other teeth.



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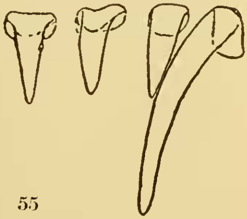

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Fig. 54.—*Sepia dannevigi* ♀ [493], two rows of teeth from radula of type ; part camera drawing from a mount in balsam.

Fig. 55.—One row of teeth from one side of another part of same preparation ; same scale.

Surface of body smooth, except for a more or less obscure succession of elongate, ridge-like tubercles running down each side of the body above and parallel to the fins.

Type.—A ♀, E2466 [S.S.B. 493], in the collection of the Australian Museum, Sydney.

Measurements.—

TABLE XVIII.—MEASUREMENTS OF *Sepia dannevigi.*

Author's Register Number	[494]	[493]
		Type.
Sex	♀	♀
	mm.	mm.
Total length	225	205
Length of body, dorsal	81	82
Length of body, ventral	66	68
Tip of body to base of dorsal arms	102	100
Width of fin at widest point	5.5	8
Width across fins	..	64
Width of body alone	54	50
Depth of body	16	15
Width of head across eyes	30	37
Length of head, nuchal cartilage to base of arms	20	20
Length of funnel, median	31	30
Length of right dorsal arm	39	27
Length of left dorsal arm	42	27
Length of right second arm	34+	29
Length of left second arm	46	29
Length of right third arm	41	33
Length of left third arm	44	33
Length of right ventral arm	47	40
Length of left ventral arm	50	43
Length of right tentacle	128	91
Length of right tentacle club	18	11
Length of left tentacle	122	104
Length of left tentacle club	18	12

Type Locality.—Investigator St. Area, south of Kangaroo Island, South Australia; ("Endeavour"); 2 ♀ ♀.

Recorded Distribution.—South of Kangaroo Island, South Australia ("Endeavour"); 20-100 fathoms, between Cape Naturaliste and Geraldton, Western Australia ("Endeavour").

Material Examined.—

TABLE XIX.

No of Specimens.	Sex.	Depth in Fathoms	Locality.	Original Number.	Author's Register	Remarks.
1	♀	..	Investigator Strait Area, S. of Kangaroo Id., S.A.	E2465	[492]	Paratype
1	♀	..	,,	E2466	[493]	Type
1	♀	20-100	Between Cape Naturaliste and Geraldton, W.A.	E2512	[491]	

Remarks.—I have been unable to identify this little species either with any of the previously recorded Australian forms or with such of those from other regions which by descriptions or figures have been available to me for comparison. It is unfortunate that the formalin used as a preserving medium has so corroded the calcareous sepiostaires that not one of the specimens retains this organ in recognisable condition, thus depriving us at the outset of a most important aid in determining the relationships of the species and defeating any possible attempt to identify it with any of the named forms heretofore known from the shell alone. We are left with the alternative of establishing a new name. Since next to nothing is known of the limits of variation in these puzzling forms, while so many of those named have been very incompletely described, I adopt this choice with the utmost diffidence. The Australian *Sepias* are in need of a thorough overhauling, but any permanent revision will necessitate abundant material from the entire circumference of the continent.

In the possession of numerous small suckers of practically similar aspect on the tentacle clubs, the present species recalls not only *S. hedleyi* but also the descriptions of such species as *S. elliptica* Hoyle, *S. cultrata* Steenstrup, *S. indica* d'Orbigny *S. smithii* Hoyle, and *S. rostrata* d'Orbigny, but in most characters, with the exception of the unknown cuttlebone, it stands apparently nearest to *S. elliptica*. They can scarcely be identical, however, since the latter is not only from a different faunal area, but is described as having subequal arms and only eight series of tentacular suckers, the horny rings of which are smooth.

The radula of very few species of *Sepia* has been illustrated, but the few figures before me do not encourage the belief that the organ undergoes any very valuable amount of specific differentiation. That of *S. tuberculata* as figured by Hoyle (1910, text fig. 10), except for its relatively shorter third laterals, is in most essentials similar to the one here described, though I cannot see that the two species are particularly near to one another in other features. The same is true of *S. arabica* (cf. Massy, 1916, pl. 24, fig. 10). Miss Massy's figure of this organ in *Sepiella inermis* (1916, pl. 23, fig. 6), on the other hand, is so utterly different from this, yet similar to that of the various species of *Loligo*, that I cannot avoid wondering whether the figure may not have suffered interchanging with that of *Loligo indica* on the succeeding plate. Our present ignorance is, however, scarcely sufficient ground for rejecting the radula of *Sepia* from taxonomic consideration, as has been emphasised by the results of recent investigation of other molluscan groups, notably the long-stubborn chitons.

All the specimens of *S. dannevigi* appear to be females, but none are gravid, and in both the two specimens partly dissected the ovary is small. There is a small duplex spermatic pad under the mouth.

The specific name is chosen in honor of the late Mr. Harald Christian Dannevig, Director of Fisheries, lost while on duty with the F.I.S. "Endeavour."

SEPIA CHIROTREMA, *sp. nov.*

(Plate lxxiv., figs. 3-9 ; Plates lxxv-lxxvii.)

Animal large, the *Body* of moderate width and depth in the ♀ (Pl. lxxvii), relatively much broader and flatter in the ♂ (Pls. lxxv.-lxxvi), the point of maximum width in both sexes a little in front of the middle, thence tapering somewhat anteriorly, and much more rapidly posteriorly to the pointed extremity ; mantle margin with a large triangular rostrum dorsally, below the funnel broadly and smoothly emarginate without distinct lateral angles. *Fins* long, quite wide for a *Sepia* (¼ to ⅓ the width of the body) ; their origin 3-5 mm. back of the mantle margin, thence sweeping back in a broad curve to swerve a little upward and terminate so that they nearly meet above and a few mm. (5 in the ♂, 15 in the ♀ paratype) in advance of the extremity of the body.*

Head slightly narrower than the body in the ♀, much narrower in the ♂. *Eyes* large. *Funnel* very large, reaching just past the base of the ventral arms.

Arms relatively short, the ventral pair about two-fifths the dorsal mantle length and much larger and longer than the other pairs, the latter regularly diminishing in size to the dorsal pair, their formula constantly 4, 3, 2, 1 ; dorsal arms relatively small, attaining only about half the length and diameter of the powerful ventral pair ; keels present on all arms, but much the most conspicuous on the ventrals. Suckers quadriserial, those of the two inner rows slightly larger than the outer, those of the four ventral arms considerably larger than those occupying corresponding positions on the four dorsal arms; suckers of ventral pair averaging 2-3 times the diameter of those of the dorsal pair, the latter seemingly particularly minute in the ♂; horny rings of arm suckers (Fig. 56) smooth, or with faintly wavy margins.

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* In the ♂ referred to the posterior lobes of the fins overreach the body; in the ♀ they fall short of it.

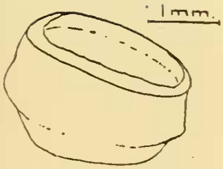

Fig. 56.—*Sepia chirotrema* ♀ [524], horny ring of 7th sucker from base of dorso-central series of right third arm; camera drawing.

Left ventral arm *hectocotylized* (Pl. lxxiv., fig. 6); basal two-fifths of arm normal, bearing ten quartets of suckers which begin rather small, increase to a maximum by about the 5th or 6th quartets, then gradually diminish again distal; at the 11th quartet, suckers showing a considerable and more abrupt diminution in size; 12th-13th quartets similar to 11th, but once again regularly smaller; from about the 14th quartet entire remaining segment of arm strongly compressed laterally, the marginal membranes, especially the dorsal, becoming relatively wider, thickened, and elevated (Pl. lxxiv., figs. 7-9), forming between them a narrow groove, in and along which the now very minute suckers continue until all details become indistinguishable near the tip of the arm.

Umbrella short, attaining its greatest extent between the arms of the third and fourth pairs; between the ventral arms of the ♀ rudimentary, somewhat better developed at this point in the ♂.

Tentacles more or less compressed, stout, very long, the length varying in different specimens from slightly more than that of the mantle to nearly twice the mantle length; inner face smooth, flattened. *Club* (Pl. lxxiv., figs. 4-5) large flattened, well expanded, the expansion largely due to the broad, fleshy keel which, commencing on the outer angle of the carpal region, becomes deflected dorsally as it passes distal, so that its major plane comes to lie parallel to and with its face continuous with the sucker-bearing face of the club; remainder of expansion due to the very broad and delicate ventral "swimming membrane," which, near the centre of the club, attains a width somewhat greater than the club itself; companion membrane of dorsal side narrower and more thick and fleshy, unique in not being everywhere continuous with the face of the club, but perforated by three large openings or fenestræ (Pl. lxxiv., fig. 5), the median of which is the largest, the distal smallest, the outline of the whole structure when fully elevated resembling somewhat a three-arched bridge with its approaches. Suckers borne ostensibly in three rows ;* carpal region and extreme base of club destitute of suckers, the marginal membranes here united across the face of the club to form a broad-limbed "V" by their divergence ; at base of the "V," either originating directly from the fused membranes themselves or with their stalks passing through the membrane substance, are four (sometimes five) rather small suckers, one of them quite conspicuously (twice or thrice) larger than the remainder; succeeding these in centre of club proper, three gigantic suckers, the middle one largest, borne on long pedicels originating in three large pockets just opposite the fenestræ in the dorsal membrane ; flanking these and alternating with them by reason of being borne on the inner face of the dorsal membrane (one respectively just above each supporting pillar (are two suckers rather smaller than the largest of the proximal group ; two fleshy folds springing from the dorsal membrane, one below each of these suckers, traverse the face of the club and are continuous with similar ridges forming the supports of the ventral membrane, finally terminating near the margin of said membrane in three small diverging buttresses ; springing from the two angles of these buttresses, two very small suckers borne by each ventral ridge, or four suckers in all in the ventral row, each pair thus corresponding to a single dorsal sucker ; distal one-fourth of club armed with 40-48 crowded suckers in 4-6 series, at first resembling those of the proximal group, then diminishing in size ventrally and toward the tip, though the two terminal suckers sheltered just below the apical cap are somewhat

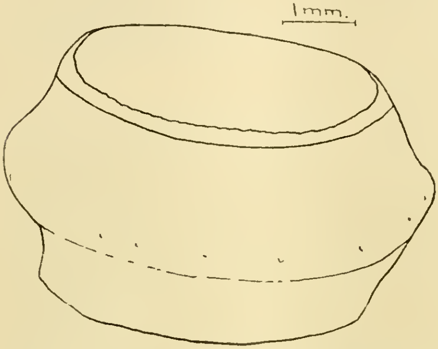

Fig. 57.—*Sepia chirotrema* ♀ [524], horny ring from central large sucker of left tentacle club ; camera drawing.

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* As will later appear, I think it evident that the fact that there are twice as many suckers in the ventralmost of these three rows than in either of the other two signifies that four rows are actually represented.

larger than those immediately preceding them, and one sucker of this pair appears to spring from the dorsal membrane; apical cap small for the size of the club. Giant median suckers elevated, cylindrical, concave beneath, with a distinct circular constriction around the middle; their apertures wide, the horny rings (Fig. 57) large and smooth-edged; smaller suckers flatter and more oblique, their horny rings also smooth. For an organ of such complexity the amount of variation in the structure of the tentacle club seems to be surprisingly small, as is indicated by Table XX.

TABLE XX.—STRUCTURE OF TENTACLE CLUB OF *Sepia chirotrema.*

Author's Register Number..	[522]		[524]		[523]		[521]	
Sex......................	♂		♀		♀		♀	
Tentacle Club............	r.	l.	r.	l.	r.	l.	r.	l.
Approximate total number suckers on distal portion of club......	46	42	37+	42	48	47	45	42
Suckers in dorsal series on main part of club..................	2	2	2	2	2	2	2	2
Suckers in ventral series on main part of club..................	4	4	4	4	4	4	4	4
Large median suckers............	3	3	3	3	3	3	3	3
Suckers in proximal group.......	4	4	5	4	4	4	4	5
Fenestræ in dorsal membrane....	3	3	3	3	3	3	3	3

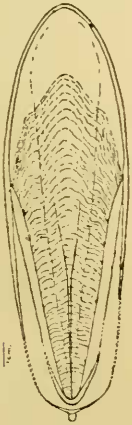

Fig. 58. — *Sepia chirotrema* ♀ [524], ventral view of gladius (sepiostaire), partially reconstructed.

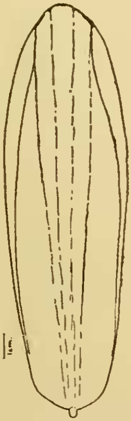

Fig. 59. — *Sepia chirotrema* ♀ [524], dorsal view of gladius (sepiostaire), partially reconstructed.

Gladius (sepiostare) elongate-oval in outline (Figs. 58-59), broadest just back of the anterior third, thence narrowing to a rounded-off angle in front, the posterior region less rapidly tapering and more truncate ; dorsal surface marked by numerous curved rows of coarse, granular, more or less confluent tubercles, the rows corresponding in position to the underlying lines of growth, and further ornamented by three low, longitudinal ridges separated by shallow fossæ of about the same width, the median ridge rendered more distinct than the others by traces of a faintly incised bounding line ; ventral surface not greatly elevated ; striated area with a broad central excavation bounded by diverging lateral elevations, the lines of growth projected sharply forward in the median line ; last loculus with an index of 16 ; inner cone tapering rather sharply to a rounded point behind, forming a somewhat broader, but still narrow, calloused wall across the terminal part of the inner cavity ; spine short, stout, blunt, the region separating it from the shell margin, ventrally, thickened and very rugose.

Radula (Fig. 61) with simple, sharply conic rhachidian and first and second lateral teeth, very similar in general appearance, though differing slightly in detail ; marginals only a little longer than the other teeth, slightly falcate in outline, their points bluntly rounded.

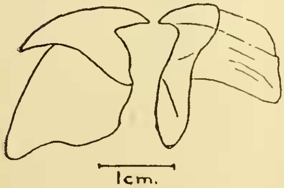

Fig. 60.—*Sepia chirotrema* ♀ [523], camera drawing of mandibles.

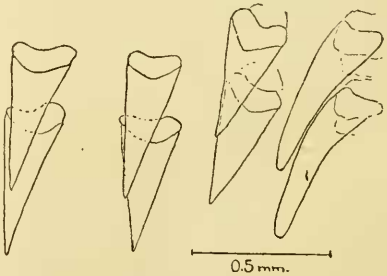

Fig. 61.—*Sepia chirotrema* ♀ [523], two rows of tooth from one side of radula of paratype ; camera drawing from a mount in balsam.

*Surface** showing traces of scattered papillæ over the dorsum ; a group of three more than usually large, conspicuous tubercles on each side of the head between the eye and the nuchal cartilage, besides three smaller tubercles in an arcuate line in front of the cartilage (cf. Pl. lxxiv., fig. 3); on each side of the body above and parallel to the fin traces of a series of about seven large tubercles, much flattened and circular in outline in the ♂, in the ♀ more elongate with a similar series of ridges below the fins.

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* In none of the specimens is the integument in condition for very detailed description.

Colour of specimens preserved in formalin mottled and clouded with bluish slate, chocolate, gray, and light brown; without traces of a definite color pattern except, firstly, a pair of broad, arcuate, slaty bands on the ventral surface of the mantle, beginning in front on either side of the funnel, but becoming indistinguishable before attaining the extremity of the body; secondly, a pair of straight, diverging, smooth, light colored bands on the middle of the head (Pl. lxxiv., fig. 3) pointing in the direction of the dorsal arms; these bands especially conspicuous on one of the ♀ specimens [524].

Measurements.—

TABLE XXI.—MEASUREMENTS OF *Sepia chirotrema.*

Author's Register Number.....	[522]	[524]	[523]	[521]
	Type		Paratype	
Sex..........................	♂	♀	♀	♀
	mm.	mm.	mm.	mm.
Total length......................	520	360	450	330
Length of body, dorsal.............	183	168	150	145
Length of body, ventral............	156	140	120	120
Tip of body to base of dorsal arms...	210	200	170	165
Width of fin at widest point	35	22	24	15
Width across fins...	160	125	110	102
Width of body alone................	110	82	73	72
Depth of body.....................	34	55+	35	55
Width of head across eyes..........	65	59	56	55
Length of head (nuchal cartilage to base of dorsal arms)..........	32	38	26	30
Length of funnel, median...........	63	52	45	48
Length of right dorsal arm.........	35+	31	50	33
Length of left dorsal arm...........	36	35	50	31
Length of right second arm.........	45	45	57	36
Length of left second arm..........	45	44	60	36
Length of right third arm..........	60	50	67	45
Length of left third arm............	55	52	65	35+
Length of right ventral arm........	87	62	80	58
Length of left ventral arm..........	85	61	75	54
Length of right tentacle............	320	170	270	190
Length of right tentacle club........	31	32	35	29
Length of left tentacle.............	280	175	270	160
Length of left tentacle club.........	31	35	35	29
Diameter of largest sucker of club..	8.4	7.4	8.5	7.6
Length of sepiostaire...............	..	168	..	..
Width of sepiostaire...............	..	50	..	..

Type.—A ♂, E2459 [S.S.B. 522], in the collection of the Australian Museum, Sydney.

Type Locality.—Investigator Strait Area, south of Kangaroo Island, South Australia (" Endeavour ") ; 1 ♂, 1 ♀.

Recorded Distribution.—South of Kangaroo Island, South Australia ; 80-120 fathoms, Great Australian Bight.

Material Examined.—

TABLE XXII.

No. of Specimens.	Sex.	Depth in Fathoms.	Locality.	Original Number.	Author's Register.	Remarks.
1	♀	80-120	Gt. Australian Bight	E2454	[521]	
1	♂	..	Investigator St. Area, S. of Kangaroo Isd., S.A.	E2459	[522]	Type
1	♀	..	,,	E2460	[523]	Paratype
1	♀	80-120	Long. 129° 28′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3621	[524]	
1	♀	,,	,,	E3622	[525]	

Remarks.—This magnificent *Sepia* I have been no more able to identify with any of the previously described forms than the two preceding species. The chief question comes in with regard to the *Sepia novaehollandiae*, Hoyle (*S. australis*, d'Orbigny, 1834, non Quoy and Gaimard, 1832). Unfortunately this is one of the species known only from the shell, and the single published figure (d'Orbigny, 1834, Seiches, pl. 7, fig. 4) has not been accessible to me, that plate and the corresponding pages of the text being lacking from my own fragmentary copy of the Histoire. As the original locality is given as " l'ile des Kangaroos, a la Nouvelle-Hollande," the specimen came from the very midst of the region explored by the " Endeavour "—excellent *prima-facie* evidence that one of the three species here described may be identical with it. As the sepiostaire of *S. dannevigi* is wholly unknown, and that of *S. hedleyi* imperfectly so, a final solution of the problem seems out of reach at the present time, but if d'Orbigny based his description upon an adult specimen, the dimensions given (long. 78 mm.) are so small as to avoid the necessity of comparison with the great *chirotrema*.

Assuming, then, that the present species is not *S. novaehollandiae*, and I do not think it is, the only other forms which would seem to require any particular comparison with it are the *S. capensis* of d'Orbigny and the *S. australis* Quoy and Gaimard,* names which appear to be absolute synonyms of one another. Following Hoyle (1912, p. 281, text fig. 8) in reviving Quoy's and Gaimard's name for the South African form, we find *S. chirotrema* to be particularly similar in the strongly elaborated mechanism of the tentacle club. This organ has fortunately been well figured for *australis* by Hoyle, but, if we are to be permitted judgment from the remarkable constancy in structural detail exhibited throughout by the "Endeavour" series, the differences are certainly of specific value. Not only this, but the localities are widely separated, while d'Orbigny expressly states that the horny rings of the large tentacular suckers are "dentelé sur son bord interne," and the suckers of the sessile arms "très-inégale en grosseur ; celles du milieu plus grosses." He could hardly have made such statements of the species now in hand. *S. australis* further appears to be a much smaller species and to have quite a different sepiostaire.

The original figures of *S. australis*, Quoy and Gaimard (copied by d'Orbigny, 1834, Seiches, pl. 12, figs. 7-11) are very confusing when correlation is attempted with subsequent work. These ostensibly show a creature with a small, conical body, its tentacle club comparatively elongate and furnished with only two rows of quite large suckers not dimorphic in size. The sepiostaire, shown in reverse, has four strong grooves, about equally spaced, radiating forward from the spine.

Gray (1849, p. 110) follows d'Orbigny in his synonymy, but in reference to certain Australian material says:—"Var. Shell larger, scarcely so arched and with much longer spine than in M. d'Orbigny's figure. Perhaps a distinct species.

a. Sydney. Shell. Dry. Presented by J. Edwards, Esq., R.N.

b. Australia. Shell. Dry. Presented by A. Sinclair, M.D.R.N."

The Sydney specimen was subsequently figured by Hoyle (1886, p. 136, text fig. 6), who further writes : "As regards the external characters of the animal, *Sepia capensis* has three suckers on the tentacle larger than the rest, and on the sessile arms the two inner series of suckers are larger than the outer," but it is evident that he is here only quoting from the older French authors.

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* As the type locality of *S. australis*, Quoy and Gaimard, is "le banc des Aiguilles à trente lieues du cap du même nom," or Cape Agulhas, the name *australis* must have been adopted in a latitudinal rather than a specifically geographical sense and at first glance is therefore a bit misleading. It is not established that Quoy's and Gaimard's species so much as occurs in Australian waters. The authentic records are all South African.

Once more turning to Figs. 58-59, it will appear that the sepiostaire of the "Endeavour" species fails to agree even reasonably well with either d'Orbigny's figure of *S. australis*, Q. and G., Hoyle's illustration of *S. capensis*, of Chapman's figures called *S. capensis* (1912, pl. 1), which last are not given to great detail and may not belong to any of the forms under discussion. To sum up, the impression which one gains from such a survey of the literature as I have outlined is that probably the true *S. australis*, Quoy and Gaimard (and hence inevitably the *S. capensis*, d'Orbigny) is unknown in the Australian fauna as it has so far been elucidated; that *S. capensis*, Gray 1849, in part, and Hoyle 1886, represents another form, possibly undescribed; and that, therefore, none of these names are properly applicable to the present species.

The specific name *chirotrema* is derived from the Greek χεὶρ (hand) and τρῆμα (perforation), having reference to the three large apertures in the dorsal membrane of the tentacle club, a feature unique so far as my own investigations have led me to inquire.

Suborder OCTOPODA.

Family POLYPODIDÆ.

Genus POLYPUS, *Schneider*, 1784.

POLYPUS, cf. AUSTRALIS (*Hoyle*, 1885).

(Plate lxxviii., figs. 1-2; plate lxxxi., fig. 1).

1885. *Octopus australis*, Hoyle—Ann. Mag. Nat. Hist. (5), v. 15, p. 224.

1885*a*. *Octopus australis*, Hoyle—Proc. Roy. Soc. Edinb., v. 13, p. 98.

1886. *Octopus australis*, Hoyle—Ceph. "Challenger" Exp., p. 9, 88, 203, 219, 226, pl. 3, figs. 4-5.

1892. *Octopus Australis*, Brazier—Cat. Ceph. Austr., p. 5.

? 1916*a*. *Polypus australis*, Massy—Ceph. "Terra Nova" Exp., p. 142, 149, text figs. 9-10.

Recorded Distribution.—6-15 fathoms, Port Jackson, New South Wales (Hoyle); George's Beach, New South Wales (Brazier); ? 200 fathoms, off Gabo Island, Victoria ("Endeavour"); ? 11-20 fathoms, Spirits Bay, New Zealand (Massy).

Material Examined.—A small ♀, E5603 [S.S.B. 536], taken in 200 fathoms, south of Gabo Island, Victoria ("Endeavour"), seems nearer to *Polypus australis* (Hoyle) than to any other described form with which comparison has seemed advisable.

Measurements.—

TABLE XXIII.—MEASUREMENTS OF *Polypus*, cf. *australis*.

Author's Register Number	[537]
Sex	♀
	mm.
Tip of body to dorsal base of umbrella	37
Length of body	29
Width of body	27
Width of neck	19
Width across eyes	19
Length of funnel	20
Mouth to tip of right dorsal arm	95
Mouth to tip of left dorsal arm	93
Mouth to tip of right second arm	80+
Mouth to tip of left second arm	105
Mouth to tip of right third arm	90+
Mouth to tip of left third arm	97
Mouth to tip of right ventral arm	50+
Mouth to tip of left ventral arm	90
Mouth to margin of umbrella between dorsal arms	14
Mouth to margin of umbrella between ventral arms	14

NOTE.—The arms of this specimen proved so brittle that the measurements given are even less accurate than usual with these difficult creatures.

Remarks.—The specimen differs from Hoyle's description of *O. australis* (Hoyle 1886, p. 88, pl. 3, figs. 4-5) in the lesser extension of the umbrella between the ventral arms, the much larger funnel, the apparently finer surface papillation, and the evenly-rounded body. Here the dorsal surface of the head and body is roughened by numerous small, angular or irregularly linear papillæ, coalesced here and there to form short ridges. The ventral surface of the body is more finely wrinkly-reticulate-papillose. Over each eye is a large, rather slender, pointed tubercle, accompanied by several very small ones. The funnel organ (Pl. lxxxi., fig. 1) is W-shaped.

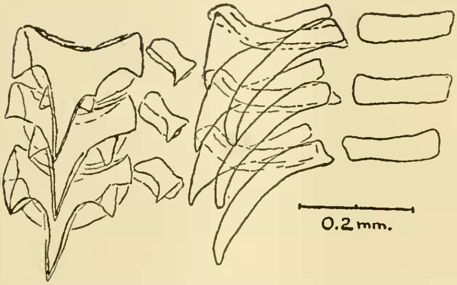

Fig. 62.—*Polypus* cf *australis* ♀ [536], three rows of teeth from one side of radula; part camera drawing from a mount in balsam.

So far as the present specimen is concerned I quite fail to detect the close relationship of *P. australis* with *P. macropus* (Risso) which has been remarked upon by Joubin and Massy, a fact which would still further lead me to doubt the correctness of the identification suggested, were it not that Miss Massy expressly mentions that her New Zealand specimens lack the ventro-lateral fold of the integument originally described for Hoyle's species. I have been unable to secure as clear a representation of the radula as that offered by Miss Massy, but I think that the differences between her fig. 9 and my Fig. 62 are too great for complete explanation in this way, and strongly indicate that her material and the " Endeavour " specimen at least are not conspecific.

POLYPUS VARIOLATUS, *de Blainville*, 1826.

(Plates lxxix-lxxx; plate lxxxi, figs. 2-3; plate lxxxii, figs. 1-4.)

? 1821. *Sepia Boscii* Lesueur—Journ. Ac. Nat. Sci. Phila., v. 2, p. 101 (*nomen nudum*).

? 1826. *Octopus variolatus*, Blainville—Dict. Sci. Nat., v. 43, p. 186.

? 1838. *Octopus Boscii*, d'Orbigny, in d'Orbigny and Férussac—Céph. Acét., p. 68.

? 1845. *Octopus Boscii*, d'Orbigny—Moll. viv. foss., p. 186.

1849. *Octopus Boscii*, Gray—Ceph. Brit. Mus., p. 12.

1852. *Octopus tetricus*, Gould—Moll. U.S. Expl. Exp., p. 474, fig. 588.

1885. *Octopus Boscii*, var. *pallida*, Hoyle—Ann. Mag. Nat. Hist., (5), v. 15, p. 223.

1885*a*. *Octopus Boscii*, var. *pallida*, Hoyle—Proc. Roy. Soc. Edin., v. 13, p. 97.

? 1886. *Octopus boscii*, Hoyle—Ceph. "Challenger" Exp., p. 8, 82, 219 (merely catalogued).

? 1886*a*. *Octopus Boscii*, Hoyle—Cat. Rec. Ceph., p. 216 [12] (merely catalogued).

1886. *Octopus boscii*, var. *pallida*, Hoyle—Ceph. "Challenger" Exp., p. 81, 203, 219 226, 228, pl. 1; pl. 3, fig. 2.

1892. *Octopus Boscii*, Brazier—Cat. Ceph. Austral., p. 3 (no description).

1892. *Octopus tetricus*, Brazier—Cat. Ceph. Austral., p. 5 (no description).

1894. *Octopus Boscii*, Joubin—Ceph. d'Amboine, p. 32.

1904. *Polypus bosci*, Hoyle—Ceph. Gulf of Manaar, p. 195.

1909. *Polypus bosci*, Hoyle—2d Suppl. Cat., p. 259 (merely catalogued).

1916. *Polypus rugosus*, (pars), Massy—Rec. Ind. Mus., v. 12, p. 189.

1916*a*. *Polypus rugosus* (pars), Massy—Ceph. "Terra Nova" Exp., p. 147.

1916. *Polypus boscii*, Hedley—Journ. Roy. Soc. West Austral., v. 1, p. 22 (merely catalogued).

Recorded Distribution.—New South Wales: Sydney (Gould, *tetricus*); 150 fathoms, off Twofold Bay (Hoyle, *pallida*).

Victoria: 38 fathoms, off East Moncœur Island, Bass Straits (Hoyle, *pallida*); eastern slopes of Bass Strait ("Endeavour").

Tasmania: 75-80 fathoms, off Tasman Head ("Endeavour"); 56 fathoms, Bay of Fires ("Endeavour"); off Flinders Island ("Endeavour"); 60-100 fathoms, 20 miles east of Babel Island ("Endeavour").

Western Australia: 80-200 fathoms, Great Australian Bight, off Eucla ("Endeavour"); Dorre Island, Sharks Bay (Lesueur, *boscii*; Blainville, *variolatus*).

Amboina (Joubin, *boscii*); Ceylon (Hoyle, *bosci*).

Material Examined —

TABLE XXIV.

No. of Specimens.	Sex.	Depth in Fathoms	Locality.	Original Number.	Author's Register
1	♀	80-120	Long. 129° 28′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3625	[526]
1	juv.	,,	,,	E3626	[567]
1	♀	160-200	Long. 127° 8′ E., Gt. Australian Bight, S. by W. of Eucla, W.A.	E4317	[520]
1	♂	deep water	Eastern slopes, Bass Strait.	E5341	[527]
1	♀	?	Australian Seas (? S.E.).	E6061	[528]
2	♀ ♀	75-80	Off Tasman Head, Tasmania.	E4879	[515]
1	♀	60-100	20 m. E. of Babel Id., Bass Strait.	E4880	[514]
1	♀	56	Bay of Fires, Tasmania.	E4885	[529]
1	juv.	..	E. coast of Flinders Id., Bass Strait.	E5602	[530]

Measurements.—

TABLE XXV.—MEASUREMENTS OF *Polypus variolatus*.

Author's Register Number.	[527]	[528]	[529]	[520]	[526]
Sex.	♂	♀	♀	♀	♀
	mm.	mm.	mm.	mm.	mm.
Total length.	375*	320*	290	215	175*
Tip of body to dorsal base of umbrella.	116	107	103	78	60
Width of body.	69	68	75	52	47
Width of neck.	55	46	43	33	30
Width of mantle opening.	46	39	40	32	28
Width of head.	53	44	42	35	31
Length of funnel.	36	..	..	25	20
Mouth to tip of right dorsal arm.	215	185	190	140	100
Mouth to tip of left dorsal arm.	225	185	190	120	100
Mouth to tip of right second arm.	240	195	200	150	107
Mouth to tip of left second arm.	245	200	210	130	108
Mouth to tip of right third arm.	200	205	210	135	118
Mouth to tip of left third arm.	265	220	220	110+	118
Mouth to tip of right ventral arm.	260+	210	215	145	130
Mouth to tip of left ventral arm.	280	210	210	145	121
Diameter of largest suckers.	12	8	8	5.5	4
Length of hectocotylus.	18	..	..	..	..
Mouth to margin of umbrella between dorsal arms.	50	50	45	27	24
Mouth to margin of umbrella between ventral arms.	80	45	45	40	24

* Estimated.

Remarks.—The " Endeavour " collection contains a large series of the remarkably handsome *Polypus*, to which I here apply, with considerable hesitation, the name *variolatus*. They are very surely referable to the race which has generally passed under the name *boscii* in the literature, but it is evident that this old name of Lesueur can have no standing.

In the first place, Lesueur published it as a mere *nomen nudum*, and in the second place even d'Orbigny, who published the name for the first time with a brief "description," recognised the insufficiency of the latter and placed *boscii* among his "Espèces incertaines." On account of the alleged great length of the arms, the species is compared by d'Orbigny with *O. cuvierii* (=*macropus* Risso), a parallel which if valid certainly signifies that it is very different from the forms which more recently have been awarded the same name.

Gray (1849) gives a more complete description than that of d'Orbigny, and it is in some accord with our specimens, but how he arrived at his determination of his material is not stated. It is clear that even assuming the correctness of Gray's general conclusions, it is impossible to date *boscii* as from Lesueur 1821. It can only hold from d'Orbigny 1838. Meanwhile de Blainville in 1826 had already published a short diagnosis of the same form under the name *Octopus variolatus*,* basing it as Lesueur originally did upon Péron's manuscript and specimens. D'Orbigny's diagnosis in fact seems throughout to be founded upon that of Blainville. Under these circumstances, if we are to recognise the older species at all, I see no escape from the rehabilitation of de Blainville's long forgotten name. The temptation to reject both names as impossible of determination is augmented by the fact that we are really not at all sure that the West Australian race to which these names must apply is identical with the lighter-colored southern and eastern specimens since described by Gray, Gould, Hoyle, *et al.* In this eventuality the next available name would seem to be *tetricus*, Gould, 1852. Though here again the description leaves much to be desired, it fits the common eastern Australian species, at least in a general way. Next comes Hoyle's *O. boscii* var. *pallida*, with which the present material is certainly conspecific.

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* I am indebted to Mr. Ellis L. Michael, of the Scripps Institution for Biological Research, for a copy of de Blainville's description in the Dictionnaire (1826, p. 186), which is as follows :—

> "Le Poulpe variolè ; O. variolatus, Péron. Corps très-grand ; peau couverte de tubercules très-serrés et très-nombreux ; appendices tentaculaires extrêmement longs, très-èpais, armès de deux rangs de ventouses arrondies et aplaties ; couleur d'un brun noir ; longeur totale, 0,60m. ou près de deux pieds.
>
> Cette grande espèce de poulpe a été trouvée par Péron et Lesueur abondamment dans les excavations des roches qui bordent la petite ile de Dorre, dans la baie de Chiens marins à la Nouvelle-Hollande. Je ne la connois que d'après une note de M. Péron, qui la rapportoit au P. rugueux de M. Bosc."

Another alternative has recently been advanced by Miss Massy in referring Hoyle's form (she does not mention the older names) to the widespread *P. rugosus* (Bosc)=*granulatus* (Lamarck). Whether one adopts this view or not it should be remembered that she has had the immeasurable advantage of access to many of the historic specimens in the Paris and British Museums with which to fortify her opinion.

The most remarkable feature of the "Endeavour" specimens is the ornamentation of the integument. The larger dorsal tubercles show a remarkably symmetrical arrangement which does not seem to have been described by other authors, though it is a conspicuous and constant feature. On the dorsum in the median line appears a series of four large, evenly spaced, branched tubercles, flanked on each side by a similar series of three to four tubercles, the middle one somewhat displaced ventrally, and by a few smaller tubercles below these. The lateral series are so placed with reference to the median that the tubercles have an appearance of being arranged in transverse as well as longitudinal rows. A similar tubercle is often borne on the base of each dorsal arm, with a more constant, larger, central one behind them. There is a somewhat smaller tubercle at the extreme posterior tip of the body. Above and behind each eye (Pl. lxxxii, figs. 2, 4) is a very large, soft, branched tubercle, accompanied by some 5-7 smaller ones. The variations observed in this general pattern as outlined are only minor. In addition to these major ornaments, the entire dorsal surface of the head and body, and the outer aspect of the arms and umbrella are covered by numerous, large, crowded papillæ (Pl. lxxxii., fig. 3), of characteristic stellate structure as described by Hoyle (1886, p. 81). These papillæ are in some specimens, such as E3625, flattened out to resemble a sort of reticulated pavement, but seem always unmistakably present, and when well preserved (cf. Pl. lxxix.) are a very beautiful feature. The papillation extends also over the entire ventral surface of the head, body, and funnel over the inner surface of the umbrella,

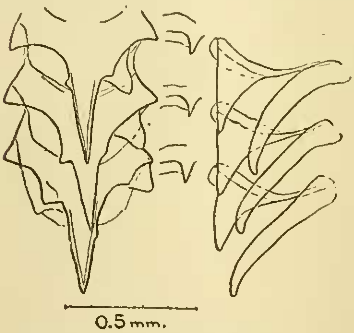

Fig. 63.—*Polypus variolatus* ♂ [527], three rows of teeth from one side of radula; part camera drawing from a mount in balsam.

and between the suckers over the oral faces of the arms, but in all these regions the papillæ are much more weakly developed than dorsally, become more numerous and crowded, and are less distinctly stellate (cf. Pl. lxxx.). The large ♀ figured (E6061) is a most beautifully preserved specimen and truly handsome.

For the specimens listed in synonymy the relative length of the arms is variously given, but in the "Endeavour" specimens, unless mutilated or indifferently preserved, the formula is quite constantly 4, 3, 2, 1. This in spite of the fact that the differences between the arms are nowhere very great and might conceivably be overbalanced at times by irregularities in the degree of contraction. In the ♂ the 10th-14th suckers on all the arms show more or less enlargement (Pl. lxxxi., fig. 3), except on the ventral pair, where it seems to be the 11th-14th.

The very large and powerful hectocotylus (Pl. lxxxii., fig. 1) does not seem to have been previously figured.

The funnel organ (Pl. lxxxi., fig. 2) is duplex. Each component is V-shaped, with broad wings and a more or less rounded posterior angle.

An illustration of the radula is given in Fig. 63.

POLYPUS, *sp. juv.*

The specimens listed in Table XXVI. are either too young or too poorly preserved to be accurately determined at this time as to species, though most of them should very probably be referred to *P. variolatus*.

TABLE XXVI.

No. of Specimens.	Sex.	Depth in Fathoms	Locality.	Original Number.	Author's Register	Remarks.
1	?	80-120	Long. 129° 28′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3624	[533]	juv.
2	?	26	Oyster Bay, Tas.	E4881	[534]	juv.
1	?	70-100	S. of Mt. Cann, Vic.	E5727	[535]	juv.
1	?	70-80	36 m. S. by 58 m. W. of Cape Wickham, King Id., Bass Str.	E6067	[531]	juv.
1	?	60-100	20 m. E. of Babel Id., Bass Strait.	E6069	[532]	juv.

E6067 and E6069 are young Polypi, having a mantle length of 15 and 20 mm. respectively, and characterised by their dark, cloudy coloration, rounded-oval body, faintly papillose surface with a few scattered tubercles, and long and slender arms, the third pair a little the longest. One large tubercle and several smaller ones are evident in the neighbourhood of each eye.

Two very small, dark Polypi (E4881), each with a mantle length of about 10 mm., are possibly referable here, as also E5727, another rather more tuberculate specimen of similar size and general appearance. It seems likely that these are all only variant juvenals of the preceding species, but as they have quite a different aspect it seems safer to mention them separately.

Specimen E3624 (Pl. lxxviii., fig. 3) has an aspect of its own. It may be the same as the above, but differs in its smoother skin, softer consistency, and more elongate body; all, however, features which might conceivably be affected by the manner of preservation.

Family CIRROTEUTHIDÆ.

Genus OPISTHOTEUTHIS, *Verrill*, 1883.

Subgenus TEUTHIDISCUS, *nov.*

Opisthoteuthids differing from the typical species (*O. agassizii*, Verrill) in the possession of a single, more or less crescentic, bar-shaped cartilage for the support of the fins, and further in the extreme degree to which the antero-posterior flattening of the body has been developed. It possibly should include all the described species of *Opisthoteuthis* excepting *O. agassizii*.

Type.—The following species.

OPISTHOTEUTHIS PLUTO, *sp. nov.*

(Plate lxxxi., figs. 4-5; Plate lxxxii., figs. 5-8; Plates lxxxiii-lxxxiv.)

Animal large, in outline subdiscoid to vasiform, according as the arms and umbrella are expanded or closed; tissues in preserved specimens wrinkled and flabby. *Body* much compressed in the peculiar fashion of the group; so completely confluent with the head, umbrella, and arms as to appear externally only as a low, rounded swelling in the centre of the disk (Pl. lxxxiii.). Fins rather large, flabby, oblong, about twice as broad as long.

Eyes moderately large, appearing as antero-lateral swellings on the central hump. *Funnel* posterior in position and direction; apparently minute as seen from the exterior, but in reality long and narrow, only the apical portion protruding; interior similarly narrow, its walls lined by a wrinkled epithelium.

Funnel organ (Fig. 64) very simple, comprising merely a pair of small, well separated, oblique, oval pads situated well back on the dorso-lateral walls of the chamber.

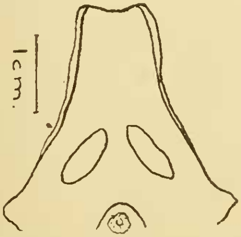

Fig. 64.—*Opisthoteuthis pluto* [468], funnel laid open along medio-ventral line to expose funnel organ.

Arms moderate, practically equal in length; little or not at all evident outwardly, and within only as sucker-bearing thickenings in the umbrella; inconsistency not much firmer than the interbrachial membrane itself. Suckers uniserial, relatively firm and hard, moderate in size, the 5th to 7th from the mouth usually the largest, thence rapidly diminishing in size proximally and more gradually distally to the extremity of the arm; first three at base very small in relation to those succeeding them; flanked on each side by an equal number of alternating cirri as usual in the genus, both suckers and cirri apparently more or less completely retractile within a circular fold of the integument sometimes forming a sort of pocket-like sheath; the pockets for receiving the cirri, sometimes, though not always, visible from the exterior through the integument, extending transversely or somewhat obliquely inward almost to the line of suckers (Pl. lxxxii., fig. 6); total number of suckers to be readily counted on each arm of a large specimen, 80-85. *Umbrella* (Pl. lxxxiv.) exceedingly ample; its greatest extension usually in front where it webs the arms (in the type) to within about 2 cm. of their tips; dorsal arms more or less curved, the concavities of the curves facing so that the margin of the web between them is relatively short; remaining arms usually evincing a tendency to curve forward, the ventral arms therefore just the reverse of the dorsal in this particular, and with the web connecting them correspondingly wide.*

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* The result of all this is that the umbrella, in fact, the entire disk, shows a much stronger bilateral symmetry than would otherwise be the case. A thoroughly similar condition, with only minor points of differ-

Colour, of specimens preserved in formalin solution, in general dark ; upper surfaces finely clouded with chocolate and dark slaty gray, the slate tone predominating, all the specimens further showing traces of a system of small, pigmented oculations as described below ; oral surface of umbrella a cloudy chocolate brown, in the larger specimens more or less overshot with dark slaty purple, the color a little paler around the mouth, deepest in the broad zone next succeeding, thence rapidly paling to the edge of the umbrella ; suckers and cirri light brownish, but the regions immediately surrounding them not usually especially lighter in hue than the interbrachial areas. Areolar spots of dorsal surface small, their size, and inversely their prominence, dependent upon their degree of expansion (Pl. lxxxi., figs. 4-5) ; typically showing a small, clear, sharply defined nucleus surrounded by a narrow zone of dark chocolate, then a wider, paler region, succeeded finally by a poorly defined zone of bluish slate, somewhat darker than and blending off into the general surface color of the surrounding integument ; in specimens at hand exact arrangement of areolæ difficult to make out ; body itself apparently free of them, but two series beginning on head between eyes extend along or nearly along the upper side of the dorsal arms, one series to each arm ; similar, but less numerous series extending along the remaining arms as well, those corresponding to the ventral pair appearing to originate near the bases of the fins, the others anterior to this point ; correspondence to all the arms usually more approximate than exact, owing to the soft, loose integument and varying state of contraction of the arms themselves.

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ence, has been described in detail by Ijima and Ikeda (1895, p. 7) for *Opisthoteuthis depressa*, so further description is not necessary here. In the largest specimens the extremities of the arms seem to extend past the web somewhat, but in small specimens the webbing extends almost to the tips, which are never excessively attenuate.

In the type the umbrella between the dorsal arms is somewhat torn on the right side at the margin where it joins the arm. The fragment remaining attached to the arm is somewhat thickened, and at first glance reminds one of the nodules which have been described in analogous positions on other species of Cirroteuthidæ by several observers, notably Hoyle and Verrill. However, since no trace of anything similar is to be found upon the remaining specimens, I believe the explanation given is correct in this instance.

Branchiæ with eight segments each.

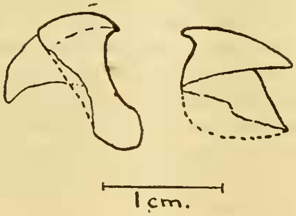

Fig. 65.—*Opisthoteuthis pluto* [472], camera drawing of mandibles.

Mandibles as in Fig. 65.

Radula absent.

Measurements.—

TABLE XXVII.—MEASUREMENTS OF *Opisthosteuthis pluto.*

Author's Register Number.......	[464]	[468]	[465]	[466]
	Type		Paratype	
	mm.	mm.	mm.	mm.
Maximum expansion (tip of right dorsal arm to tip of left ventral arm).......	540	350	275	195
Width across fins......................	210	115	115	70
Width of fin (right)...................	60	30	20	10
Maximum length of fin..................	30	15	10	5
Width across eyes......................	100	70	75	30
Length of funnel.......................	..	28	21	..
Mouth to tip of right dorsal arm.........	260	160	145	85
Mouth to tip of left dorsal arm..........	260	160	145	85
Mouth to tip of right second arm........	250	155	150	85
Mouth to tip of left second arm.........	250	155	140	85
Mouth to tip of right third arm..........	270	170	140	90
Mouth to tip of left third arm...........	245	145	145	90
Mouth to tip of right ventral arm........	245	160	115+	85
Mouth to tip of left ventral arm.........	250	160	130	90
Diameter of body of 5th sucker from base, right dorsal arm	7	4	3.5	2
Mouth to margin of umbrella between dorsal arms.....................	170	105	95	60
Mouth to margin of umbrella between second and third arms.............	145	95	100	55
Mouth to margin of umbrella between ventral arms.....................	140	100	80	55

NOTE.—Though great care was taken, the very nature of the animals renders most of the above measurements extremely uncertain. They are, in fact, as a rule, little more than estimates, and hence of value only in the most general way.

*Pteropallial cartilage** (Pl. lxxxii., figs. 7-8) broadly U-shaped, posterior in position, its pointed horns extending past the base of but not into the fins ; fins muscles large, broadly attached at the base to the tough, ensheathing membrane of the cartilage, the latter at this region showing a vertical thickening, then a rapid tapering, the outer surface here abruptly flattened and even slightly excavated at the point of expansion ; a groove, broad and shallow at first, but gradually narrowing and deepening posteriorly, extends around the entire periphery of the cartilage between the two flattened areas (Pl. lxxxii., fig. 8).

Type.—Specimen E3628 [S.S.B. 464], in the collection of the Australian Museum, Sydney. A paratype [S.S.B. 465] has been retained by the writer.

Type Locality.—350-450 fathoms, long. 129° 28′ E., Great Australian Bight ("Endeavour") ; one specimen.

Recorded Distribution.—150-350 fathoms, Great Australian Bight, off coasts of South and Western Australia ("Endeavour").

Material Examined.—

TABLE XXVIII.

No. of Specimens.	Depth in Fathoms	Locality.	Original Number.	Author's Register	Remarks.
1	350-450	Long. 129° 28′ E., Gt. Australian Bight.	E3628	[464]	Type
1	200	Long. 126° 10′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3629	[465]	Paratype
1	"	"	E3630	[466]	
1	"	"	E3631	[467]	juv.
1	150	Long. 130° 10′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3632	[468]	
1	160-200	Long. 127° 8′ E., Gt. Australian Bight, S. by W. of Eucla, W.A.	E4318	[469]	juv.
1	"	"	E4319	[470]	juv.
1	"	"	E4320	[471]	
1	"	"	E4321	[472]	dissected
1	"	"	E4322	[473]	
1	175	Long. 128° 40′ E., Gt. Australian Bight, SW. by S. of Eucla, W.A.	E4373	[474]	juv.
1	"	"	E4374	[475]	juv.
1	"	"	E4375	[476]	juv.

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* This term is probably here used for the first time. It is the equivalent of the "dorsal cartilage" or "Rückenknorpel" of various authors, and the "Flossenstütze" of Meyer.

Remarks.—*Opisthoteuthis* is not, even after all the years since its original description, so common a genus but that the discovery of specimens is almost *per se* a matter of considerable interest. Their comparative abundance in the present instance is therefore rendered especially noteworthy. These Australian examples differ from the type of the genus and approach the Japanese *O. depressa* in the very great extent to which the compression of the body has been carried. *O. agassizii* further differs in that its pteropallial cartilage is a *paired* organ, its components being said to extend into the fins on either side. This feature would certainly seem important enough for taxonomic recognition, and is the principal basis for the establishment of the subgenus here proposed. *O. depressa* also falls under *Teuthidiscus* rather than the typical group, and I suspect that both the other described species, *O. medusoides*, Thiele and *O. extensa*, Thiele, belong here likewise, though their skeletal characters have not yet been made known. Superficially at least, *O. extensa* seems nearer to the form now described than do any of the other species, so much in fact that it is not impossible that it may prove conspecific when better known. However, from Thiele's description and figures it would appear to have smaller, more median fins, a less extensive umbrella, more attenuate arms, and smaller, more uniform suckers. It is not represented as areolate. The gills are said to have only six divisions, as against eight in *O. pluto.* But it must be said that none of these differences are very striking.

Even small specimens of *O. pluto*, down at least to a diameter of 75 mm., are readily distinguishable by their characteristic coloration, as well as usually by their usually flabbier, stringier, and less gelatinous consistency than that shown by (*e.g.*) specimens of *O. persephone.* The depressed, discoid outline, however, does not invariably hold in preserved material. In several specimens, notably E4321, the body is elevated and slightly constricted at the junction with the umbrella, while in a few specimens, as E4319 and E4320, the umbrella is closed and the body pushed out so that the general shape more approaches that of a *Cirroteuthis.*

Portions of skin containing areolæ were delaminated and mounted. Both stained (Delafield's hæmatoxylin) and unstained preparations were made in the hope of obtaining some clue as to their nature or the possibility of the nuclear mass containing photogenic tissue. But the tissues proved to have suffered too much disorganisation to show their true character or to justify further investigation by sectioning. The central clear region was conspicuous as a circular or ovate mass of pale, flocculent material lying beneath the surface membrane and surrounded by a narrower line of a clearer substance as though perhaps enclosed in a transparent sac. The flocculent material was better seen in the unstained, the sac-like boundary in the stained preparation. Superficially the areolae remind one somewhat of the oculations occurring in the integument of such octopods as *Polypus marmoratus*, *P. bimaculatus*, etc., but a similar mounted preparation of one of the areolae of a specimen of *P. bimaculatus* from Laguna Beach, California [S.S.B. 324] shows no trace of either a sac-like organ or submerged flocculent tissue. In the case of the *Polypus* the oculation seems to be mainly, if not wholly, a matter of the arrangement, number, and color of the chromatophores.

The Australian records constitute a considerable and interesting extension of the known range of the genus.

OPISTHOTEUTHIS PERSEPHONE, *sp. nov.*

(Plate lxxxi., figs. 6-7; Plate lxxxii., figs. 9-10; Plates lxxxv.-lxxxviii.)

Animal of moderate size, in outline subdiscoid when fully expanded (Pl. lxxxvii., fig. 1), otherwise more or less vasiform (Pl. lxxxvii., fig. 2); tissues wrinkled and flabby. *Body* compressed, completely confluent with the head, the whole blending into the arms and umbrella so as to appear in the expanded phase but a poorly defined elevation or thickening in the centre of the disk. *Fins* minute, tenuous, more or less median in position; usually more than twice as broad as long.

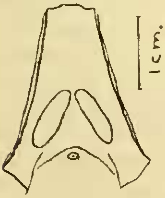

Fig. 66.—*Opisthoteuthis persephone* [481], funnel laid open along medioventral line to expose funnel organ.

Eyes rather small and inconspicuous. *Funnel* posterior in position and direction in the discoid phase; tubular; very narrow and slender; aperture small; interior lined with a very delicate epithelium.

Funnel organ in general outline and position similar to that of the preceding species, comprising a pair of small, oval pads placed well back on the dorsal wall of the cavity and pointing toward one another in front, but the component pads apparently much larger in proportion to the general dimensions of the cavity, as well as more slender than in *O. pluto* (Fig. 66).*

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* The funnel organ proved extremely difficult to make out satisfactorily because of the mass of mucus which, in the specimen figured, filled the funnel chamber. In a second specimen examined, the organ was quite indistinguishable.

Arms rather short; sometimes apparent from above, but usually evident only as stout cartilage-like thickenings in the umbrella. Suckers uniserial and very small; essentially equal in size over almost the entire length of the arm, only the three basalmost and those toward the tip being appreciably, though gradually, smaller than the remainder; 12th-18th possibly largest in the series, but this a point difficult if not impossible to specify; usually well elevated; in the vasiform stage with umbrella closed the suckers very close together in a given series, more distant in the fully expanded phase, as also in the preceding species; each series flanked on each side at a distance of perhaps three sucker-diameters by a series of small, retractile, glove-finger-like, pointed cirri corresponding in number to and occurring in apparent alternation with the suckers; the narrow pockets into which the cirri retract very conspicuous in this species (Pl. lxxxii., fig. 9), due very likely to the pale color of the contained portion of the cirri as contrasted with the dark pigmentation of the subjacent tissues, in outline straight, extending transversely from the small, crescentic openings about two-thirds the distance to the row of suckers, or sometimes obliquely backward, depending upon the position or state of contraction of the surrounding tissues; suckers themselves likewise more or less retractile, though rarely, so far as seen, to the same degree as in *O. pluto*; total number of suckers to be made out clearly by the naked eye on the arms of the right side of type 1-78, 2-78, 3-72, 4-72. *Umbrella* (Pls. lxxxvi, lxxxviii) ample, its greatest extension usually in front, though it extends between all the arms nearly to their extremities, the latter being more attenuate and free of the web for a slightly greater distance than in *O. pluto.* A bilateral symmetry in the disposition of the arms and web is to be found here as in *O pluto*, but the peculiar curvatures of the arms noted in the case of the latter species are not so evident in the present series of specimens.

Colour of specimens preserved in formalin solution; outer or aboral surfaces of the type and other Victoria specimens practically colorless, or a sort of dirty gray, except for traces of small areolae and of a delicate, much torn, superficial membrane lightly pigmented with streaks of brown; oral surfaces with the superficial integument colorless and transparent, its interbrachial portions *very loose*, lying in soft folds and wrinkles over the smooth, pigmented layer beneath, the dark bluish slate of the pigmented layer showing through everywhere except that it is paler along the arms and over a ring-like zone a little distance from the mouth; suckers and cirri light yellowish brown, contrasting strongly with the general slaty hue. Small specimens from off Eucla differing in that the light ring round the mouth is more sharply marked off from the dark mouth region and the dark area outside; the aboral surface furthermore a uniform grayish white without evident pigmentation, except for a series of 3-7 tiny ocellar spots running from the body out toward the tip of each arm, each areola (Pl. lxxxi., figs. 6-7) showing a small, clear central area as in *O. pluto*, often appearing slightly elevated, but each areola as a whole much more minute.

Pteropallial cartilage (Pl. lxxxii., fig. 10) in general similar to that described for *O. pluto*, but relatively shallower, broader, and thinner, the fin attachments narrower, and the lateral flattenings, though somewhat more excavated, not so abrupt; peripheral groove also apparently somewhat shallower, though a more accurate description and drawing than that offered is prevented by the extremely soft and brittle condition of the specimens.

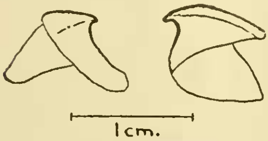


Fig. 67.—*Opisthoteuthis persephone* [484], camera drawing of mandibles.

Mandibles (Fig. 67) and buccal mass relatively small, much smaller than in the dissected specimen of *O. pluto*, though the latter is a smaller animal; upper mandible also differing in the possession of a distinct angle along each outer side of the beak at the shoulder.

Branchiæ six on one side, six + one poorly developed on the other. *Pallial muscle* back of funnel extremely weak.

Type.—Specimen E5718 [S.S.B. 480], in the collection of the Australian Museum, Sydney. A paratype [S.S.B. 482] has been retained by the writer.

Type Locality.—260 fathoms, 42 miles south and east of Genoa Peak, Victoria ("Endeavour"); three specimens.

Recorded Distribution.—232-260 fathoms, off Genoa Peak, Victoria ("Endeavour"); 150-300 fathoms, off Eucla, Western Australia ("Endeavour").

Remarks.—The more tangible characteristics by which this exceedingly interesting octopod may be distinguished from its accompanying relative, *O. pluto*, are the small, even-sized suckers, the distinctive coloration more especially over the oral aspect of the arms and web, the firm composition of the

Measurements.—

TABLE XXIX.—MEASUREMENTS OF *Opisthoteuthis persephone.*

Author's Register Number	[480]	[484]	[477]
	Type.		
	mm.	mm.	mm.
Maximum expansion (tip of right dorsal arm to tip of left ventral arm)	330	225	170
Width across fins	75	..	..
Width of fin	20	15	15
Maximum length of fin	14	7	6
Width across eyes	50	40	35
Length of funnel	..	8	..
Mouth to tip of right dorsal arm	165	110	80
Mouth to tip of left dorsal arm	150	110	80
Mouth to tip of right second arm	160	115	85
Mouth to tip of left second arm	160	115	85
Mouth to tip of right third arm	175	125	90
Mouth to tip of left third arm	170	120	75+
Mouth to tip of right ventral arm	165	125	90
Mouth to tip of left ventral arm	165	110	90
Diameter of body of 5th sucker from base, right dorsal arm	2+	2	1.1
Mouth to margin of umbrella between dorsal arms	100	80	60
Mouth to margin of umbrella between second and third arms	105	85	60
Mouth to margin of umbrella between ventral arms	115	85	60

Material Examined.—

TABLE XXX.

No. of Specimens.	Depth in Fathoms	Locality.	Original Number.	Author's Register	Remarks.
1	150	Long. 130° 10′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3633	[477]	discoid
1	,,	,,	E3634	[478]	,,
1	250-300	Long. 130° 50′ E., Gt. Australian Bight, S. of Eucla, W.A.	E3638	[479]	,,
1	260	42 m. S. and E. of Genoa Peak, Victoria.	E5718	[480]	Type
1	,,	,,	E5719	[481]	Paratype
1	,,	,,	E5720	[482]	Paratype
1	232	40 m. S.E. and S. of Genoa Peak, Victoria.	E5721	[483]	
1	,,	,,	E5722	[484]	dissected

arms, and *perhaps* the smaller size. The sum total of these features is an *ensemble* rather difficult to describe, but which very soon enables one to separate the two species with considerable accuracy almost as rapidly as the specimens can be handled, and this seems to be true even aside from the differences in color.

The three small specimens from ff Eucla have a certain facies of their own (Pl. lxxxvii., fig. 1; pl. lxxxviii., fig. 1), and I at first felt some doubt as to whether they might not represent a third species. I am now inclined to think them simply young *persephone* which have chanced to be preserved in the discoid phase.

This species, particularly if the conclusions in the last paragraph are true, finds its nearest relatives in the well-known Japanese *O. depressa*, and perhaps the curious little *O. medusoides*, Thiele. At any rate these are the only species with which it would seem to require any special comparison. It resembles both in the concentrically bicolored oral surface and the pale aboral area, but *O. medusoides*, which impresses one as more or less juvenile in many of its characteristics, is rather differently shaped and has larger fins, besides having the inside of the web figured as reddish brown rather than slaty. *O. depressa* differs notably in the simple, straight, bar-like form of the pteropallial cartilage, which does not seem to extend forward to the fins as in the Australian species.

LITERATURE CITED.

BERRY, S. S.

1912. A catalogue of Japanese Cephalopoda. Proceedings Academy Natural Sciences Philadelphia, 1912, p. 380-444, text fig. 1-4, pl. 5-9. October 1912.

1914. The Cephalopoda of the Hawaiian Islands. Bulletin United States Bureau Fisheries, v. 32, p. 255-362, text fig. 1-40, pl. 46-55. June 1914.

BLAINVILLE, H. D. DE

1826. [Art.] Poulpe. [In] Dictionnaire des Sciences Naturelles, v. 43, p. 170-214. 1826.

BRAZIER, J.

1892. Catalogue of the marine shells of Australia and Tasmania. Part I Cephalopoda. Australian Museum Catalogue, no. 15, p. i-vi, 1-17. 1892.

CHAPMAN, F.

1912. Note on the occurrence of some Sepias new or little known to the Victorian coast. Victorian Naturalist, v. 29, p. 23-25, pl. 1. 1912.

CHUN, C.

1910. Die Cephalopoden. I. Teil: Oegopsida. Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia," 1898-1899, Bd. 18, p. 1-402, 2 pl. and 32 fig. in text, Atlas of 61 pl., Jena 1910.

1915. Die Cephalopoden. II. Teil: Myopsida Octopoda. Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899, Bd. 18, p. 403-552 [1-150], text fig. 33-71, pl. 62-95, Jena, 1915. (The title page of the volume gives the date of the second portion as 1914, but the publisher's board covers for the same part bear the date 1915.)

GIRARD, A. A.

1890. Revision des Mollusques du Muséum de Lisbonne. 1. Céphalopodes. Jornal de Sciencias Mathematicas, Physicas e Naturaes (2), v. 1, p. 233-268, 1 pl., 1890.

GOODRICH, E. S.

1896. Report on a collection of Cephalopoda from the Calcutta Museum. Transactions Linnean Society, London, (2, Zool.), v. 7, p. 1-24, pl. 1-5. December 1896.

GOULD, A. A.

1852. Mollusca and Shells. Reports United States Exploring Expedition, etc., under the command of Charles Wilkes, v. 12, p. i-xv, 1-510, Atlas of 52 pl., Philadelphia, 1852.

GRAY, J. E.

1849. Catalogue of the Mollusca in the collection of the British Museum. Part I. Cephalopoda Antepedia. P. i-viii, 1-164, small 8vo, London, 1849.

HEDLEY, C.

1916. A preliminary index of the Mollusca of Western Australia. Journal Royal Society Western Australia, v. 1, p. 1-77, 1916.

Hoyle, W. E.

1885. Diagnoses of new species of Cephalopoda collected during the cruise of H.M.S. “Challenger.” Part I. The Octopoda. Annals and Magazine Natural History, (5), v. 15, p. 222-236. March 1885.

1885*a*. Preliminary report on the Cephalopoda collected by H.M.S. “Challenger”—Part I. The Octopoda. Proceedings Royal Society, Edinburgh, v. 13, p. 94-114, cuts. August 1885.

1886. Report on the Cephalopoda collected by H.M.S. “Challenger” during the years 1873-1876. Voyage of the “Challenger,” v. 16, pt. 44, p. i-vi, 1-246, 10 fig. in text, map, pl. 1-33. 1886.

1886*a*. A catalogue of recent Cephalopoda. Proceedings Royal Physical Society Edinburgh, v. 9, p. 205-267 [1-63], 1886.

1897. A catalogue of recent Cephalopoda. Supplement, 1887-96. Proceedings Royal Physical Society Edinburgh, v. 13, p. 363-375 [1-13], 1897.

1904. Report on the Cephalopoda collected by Professor Herdman, at Ceylon, in 1902. Report to the Government of Ceylon on the pearl oyster fisheries of the Gulf of Manaar, Supplementary Report 14, p. 185-200, pl. 1-3, 1904.

1909. A catalogue of recent Cephalopoda. Second Supplement. 1897-1906. Proceedings Royal Physical Society Edinburgh, v. 17, p. 254-299, October 1909.

1910. Mollusca: Cephalopoda. in Schultze: Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika, etc., p. 261-268, pl. 5a, Jena, 1910.

1912. The Cephalopoda of the Scottish National Antarctic Expedition. Transactions Royal Society Edinburgh, v. 48, p. 273-283, 9 text fig., May 1912.

Hutton, F. W.

1882. Notes on some branchiate Mollusca. Transactions New Zealand Institute, v. 14, p. 162-171, pl. 6-7, 1882.

Ijima, I., and Ikeda, S.

1895. Description of Opisthoteuthis depressa, n. sp. Journal College Science, Imperial University Tokyo, v. 8, p. 1-15, pl. 33, 1895.

ISHIKAWA, C.

1914. Ueber eine neue Art von Enoploteuthis, Enoploteuthis, chunii spec. nov. aus. Uwodu, Japanisches Meer. Journal College Agriculture Imperial University Tokyo, v. 4, p. 401-413, pl. 38-39, July 1914.

JOUBIN, L.

1894. Céphalopodes d'Amboine. Revue suisse de Zoologie, v. 2, p. 23-64, pl. 1-4, 1894.

LESUEUR, C. A.

1821. Descriptions of several new species of cuttle-fish. Journal Academy Natural Sciences Philadelphia. v. 2, p. 86-101, pl. 6-12, 1821.

MASSY, ANNE L.

1916. The Cephalopoda of the Indian Museum. Records Indian Museum, Calcutta, v. 12, p. 185-247, pl. 23-24. September 1916.

1916a. Mollusca. Part II.—Cephalopoda. British Antarctic ("Terra Nova") Expedition, 1910, Natural History Report, Zoology, v. 2, p. 141-176, text fig. 1-43, November 1916.

McCOY, F.

1883. Prodromus of the Zoology of Victoria; or, figures and descriptions of the living species of all classes of the Victorian indigenous animals. Decade 8, p. 1-36, pl. 71-80, Melbourne, 1883.

1888. Prodromus of the Zoology of Victoria; or figures and descriptions of the living species of all classes of the Victorian indigenous animals. Decade 17, p. 225-257, pl. 161-170, Melbourne, 1888.

D'ORBIGNY, A., and FERUSSAC, A. DE

1834-'48. Histoire naturelle générale et particulière des céphalopodes acétabulifères, vivants et fossiles. Paris, 1834-1848.

D'ORBIGNY, A.

1845. Mollusques vivants et fossiles ou description de toutes les espéces de coquilles et de mollusques classées suivant leur distribution géologique et géographique. V. 1, p. 1-605. Atlas of 35 pl., Paris, 1845-1847; repr. in 1855.

PFEFFER, G.

1900. Synopsis der oegopsiden Cephalopoden. Mitteilungen aus dem Naturhistorischen Museum, Hamburg, 17, p. 147-198, 1900.

1908. Die Cephalopoden. Nordisches Plankton, 9 Lief., IV, p. 9-116, 120 text fig., Kiel and Leipzig, 1908.

1912. Die Cephalopoden der Planktonexpedition, Zugleich eine monographische Uebersicht der Oegopsiden Cephalopoden. Ergebnisse Plankton-Expedition der Humboldt-Stiftung, Bd. 2, p. i-xxi. 1-815, Atlas of 48 pl., 1912.

QUOY, J. R. C., and GAIMARD, J. P.

1832. Zoologie, in Voyage de l'Astrolabe, pendant les années 1826-1829, etc., v. 2, Paris, 1832.

SASAKI, M.

1916. Notes on oegopsid cephalopods found in Japan. Annotationes Zoologicae Japonenses, v. 9, p. 89-120, pl. 3, 1916.

THIELE, J.

1915. See Chun, C., 1915.

TRYON, G. W.

1879. Cephalopoda. Manual Conchology, v. 1, 316 p., 112 pl., Philadelphia, 1879.

VERRILL, A. E.

1880-81. The cephalopods of the north-eastern coast of America. Part II. The smaller cephalopods, including the squids and the Octopi, with other allied forms. Transactions Connecticut Academy Sciences, v. 5, p. 259-446, pl. 26-56, June 1880-December 1881.

VON MARTENS, E.

1889. Forschungsreise S.M.S. "Gazelle." III Theil : Zoologie und Geologie, p. 191, Berlin, 1889.

WUELKER, G.

1913 Cephalopoden der Aru- und Kei-Inseln. Anhang : Revision der Gattung Sepioteuthis. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft, Bd. 34, p. 451-488, text fig. 1-7, pl. 22, 1913.

EXPLANATION OF PLATES.

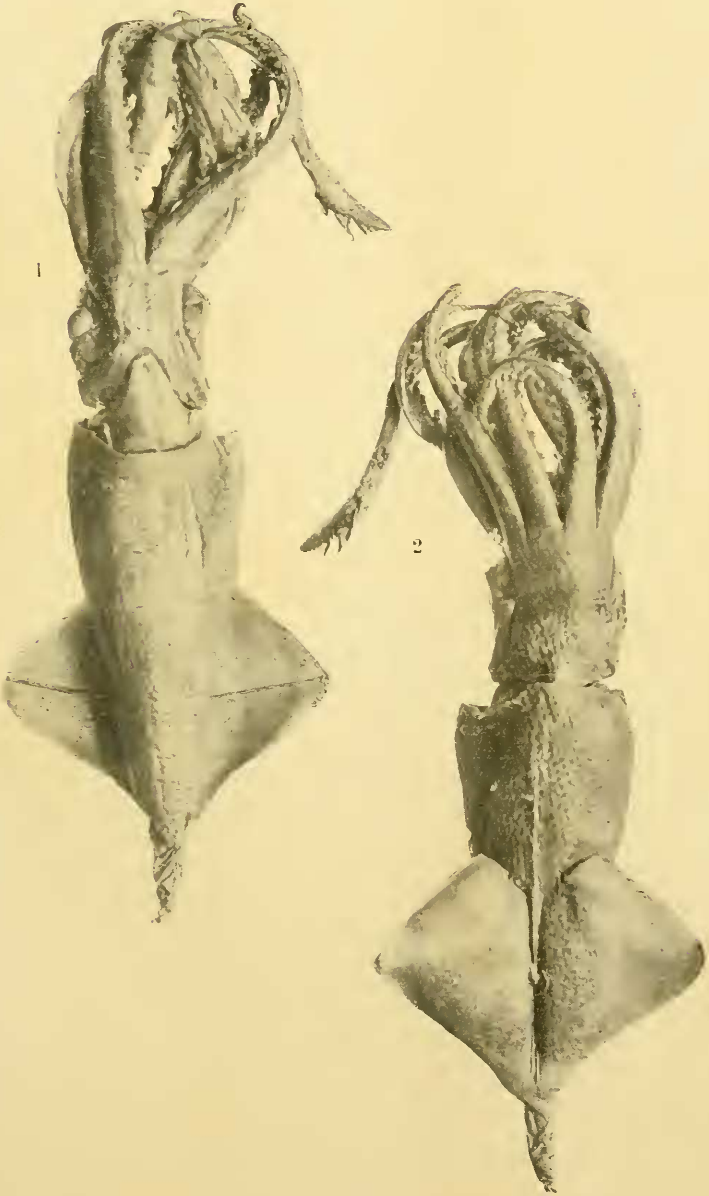
NOTE.—Except where otherwise indicated, practically all the drawings in the following plates are from the pen of Mr. Herbert J. Powell, of Redlands, California. The wash drawings and certain others designated are by Mr. Robert N. Wenzel, of Stanford University. The photographs are by Mr. E. F. Everitt, of Redlands, California. They have not been retouched except as to the backgrounds.

EXPLANATION OF PLATE LIX.

Enoploteuthis galaxias, ♀.

Fig. 1.—Ventral aspect of type specimen [543]; approximately natural size.

Fig. 2.—Dorsal aspect of same; same scale.



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EXPLANATION OF PLATE LX.

Enoploteuthis galaxias.

Fig. 1.—Oral face of right tentacle club of type specimen, ♀ [543].

Fig. 2.—Oral face of right tentacle club of paratype, ♂ [544], same scale.

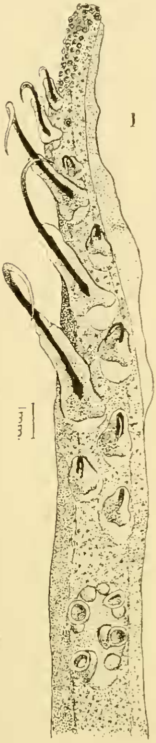
Fig. 3.—Tip of right third arm of type, ♀ [543].

Fig. 4.—Oral aspect of right ventral arm of paratype, ♂ [544].

Fig. 5.—Distal portion of same, seen under greater magnification.

Fig. 6.—Photophores from ventral periphery of right eyeball of paratype, ♀ [462]; part camera sketch from mount in balsam.

Fig. 7.—Funnel of paratype, ♀ [462], laid open along medioventral line to show the funnel organ.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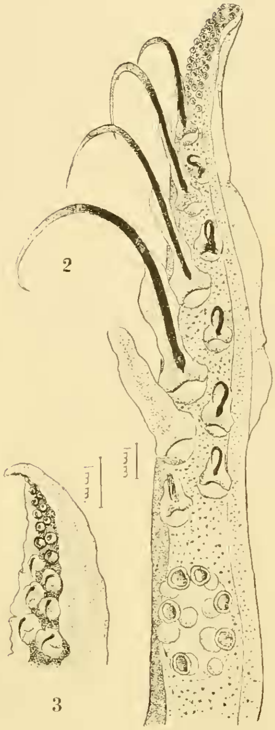
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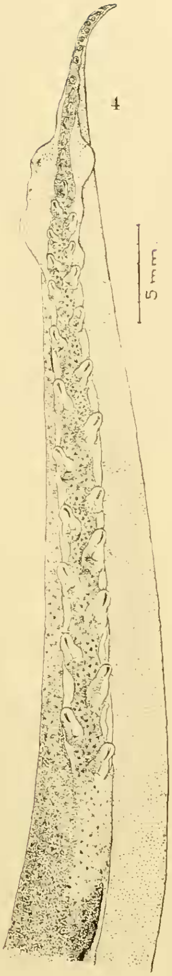
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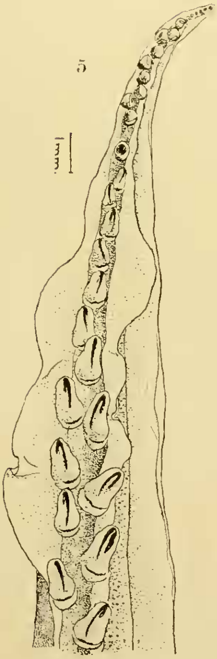
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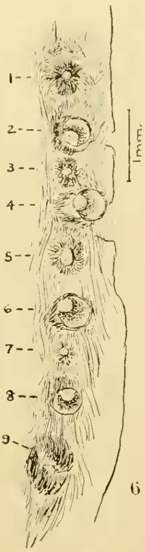
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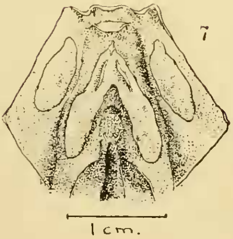
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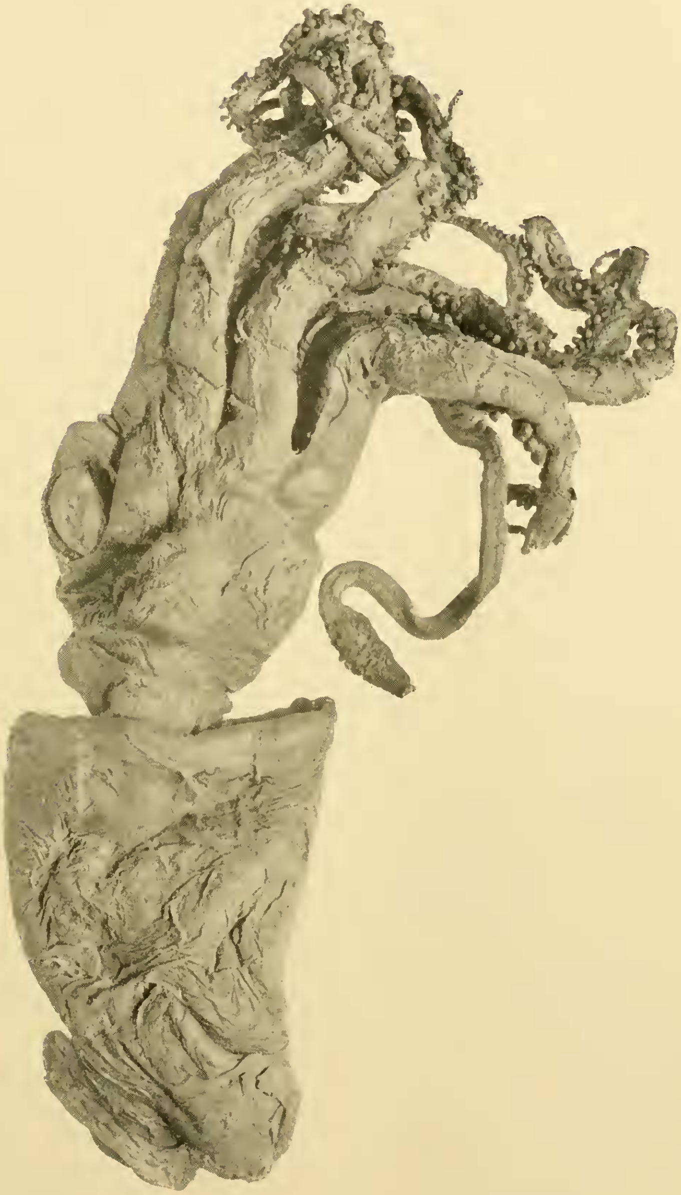
EXPLANATION OF PLATE LXI.

Calliteuthis miranda, ♀.

Dorsal aspect of type specimen [545]; × ½.



EXPLANATION OF PLATE LXII.

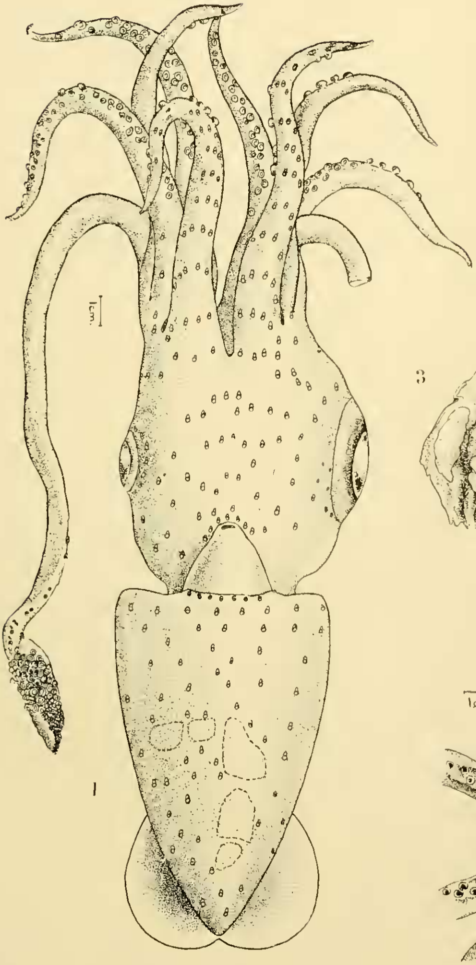
Calliteuthis miranda, ♀.

Fig. 1.—Ventral aspect of type specimen [545].

Fig. 2.—Oral aspect of right tentacle club of type specimen [545]. Drawn by R. N. Wenzel.

Fig. 3.—Funnel of type specimen [545] laid open along medio-ventral line to show funnel organ Drawn by R. N. Wenzel.

Fig. 4.—Oral region of type specimen [545].



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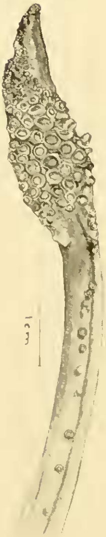

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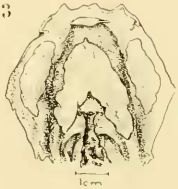

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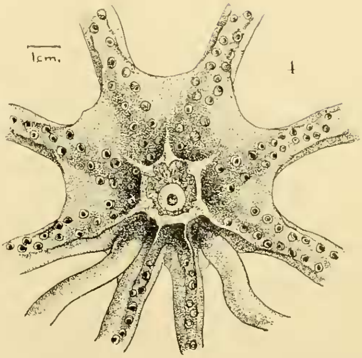

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EXPLANATION OF PLATE LXIII.

Nototodarus gouldi.

Fig. 1.—Dorsal aspect of young ♂ [554]; × $\frac{1}{3}$.

Fig. 2.—Ventral aspect of same; same scale.

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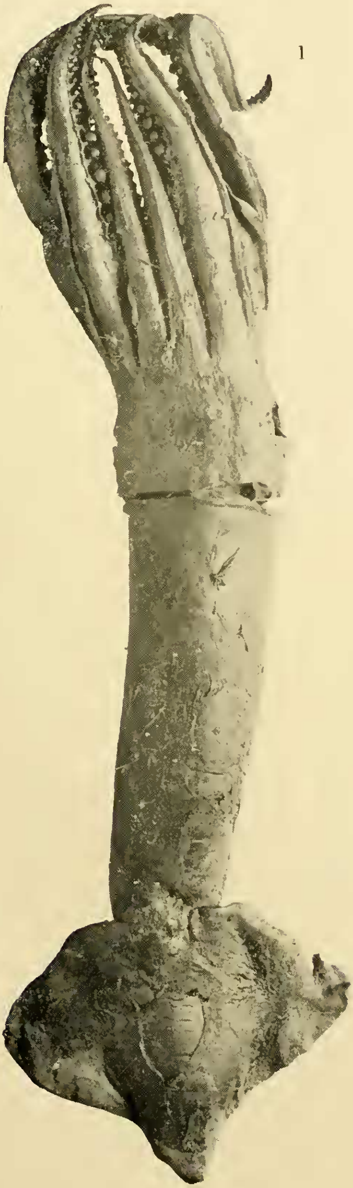

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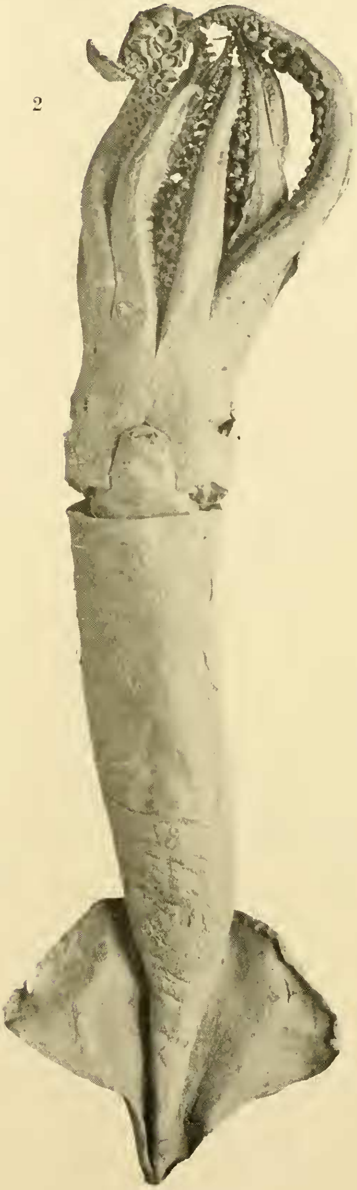
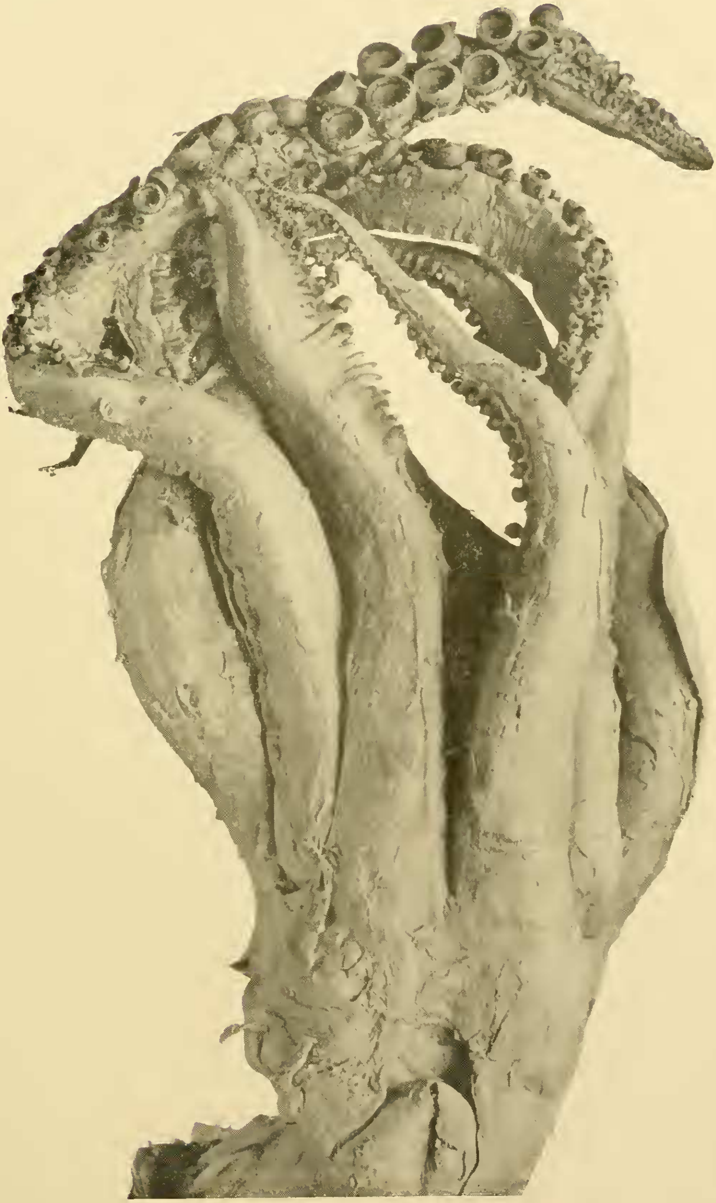


EXPLANATION OF PLATE LXIV.

Nototodarus gouldi.

Ventral aspect of head and arms of adult ♂ [562]; $\times \frac{4}{5}$



EXPLANATION OF PLATE LXV.

Nototodarus gouldi.

Fig. 1.—Apical portion of funnel groove of large ♀ [548], showing foveola.

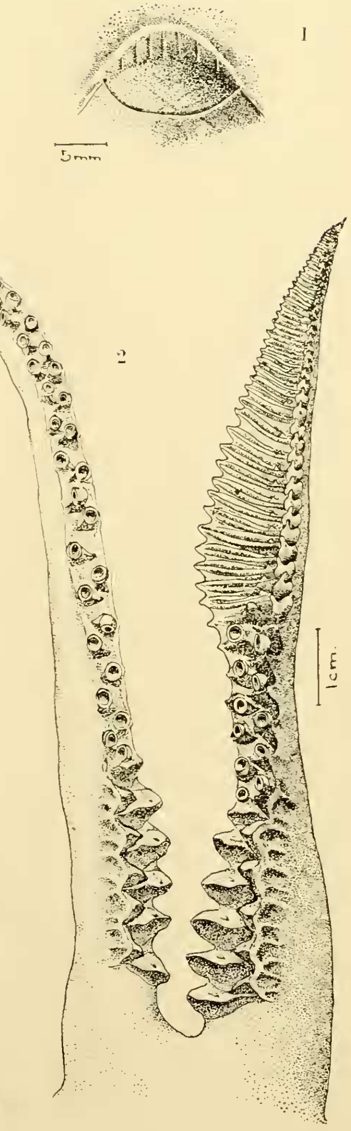
Fig. 2.—Oral aspect of ventral arms of adult ♂ [549], showing hectocotylization.

Fig. 3.—10th-15th pairs of the tubercle-sucker-papilla series of right ventral arm of same specimen, seen in greater magnification, oral aspect.

Fig. 4.—Lateral aspect of same region of same arm, showing units 9-17 of the dorsal series of suckers and papillæ; same scale.

Fig. 5.—Outer aspect of units 18-21 of ventral row of same arm; same scale.

Fig. 6.—Outer aspect of tubercles 3-4 of ventral row on basal portion of same arm; same scale.



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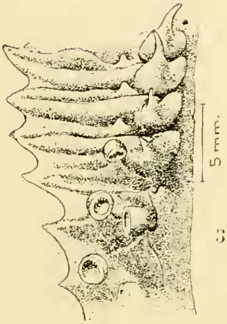

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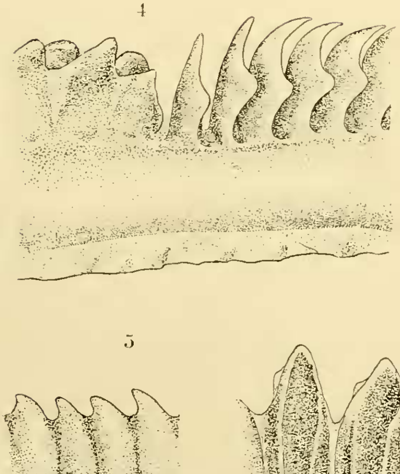

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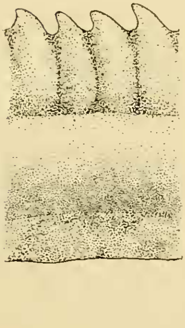

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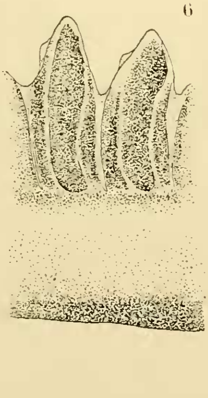


EXPLANATION OF PLATE LXVI.

Nototodarus gouldi.

Fig. 1.—Funnel of large ♀ [510], laid open along medioventral line to show funnel organ.

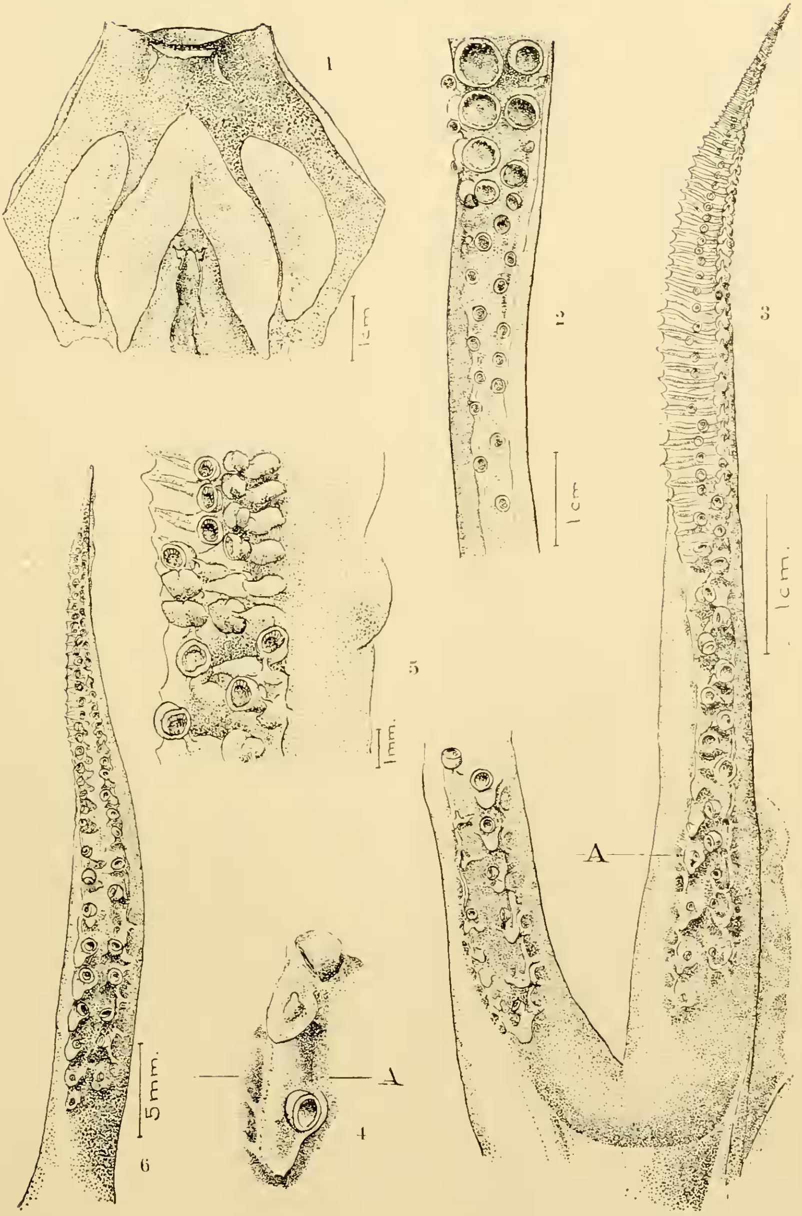
Fig. 2.—Carpal region of left tentacle club of large ♀ [560], oral aspect, showing the fixing apparatus.

Fig. 3.—Right ventral arm and basal portion of left ventral arm of an immature ♂ [553], showing advanced stage in development of hectocotylus.

Fig. 4.—Units 4-5 of ventral sucker-papilla series of right ventral arm seen in greater magnification.

Fig. 5.—Oral face of right ventral arm of an immature ♂ near base of modified distal portion (Cf. Pl. LXV., fig. 3).

Fig. 6.—Oral aspect of right ventral arm of young ♂ [550], showing early stage of development of hectocotylus.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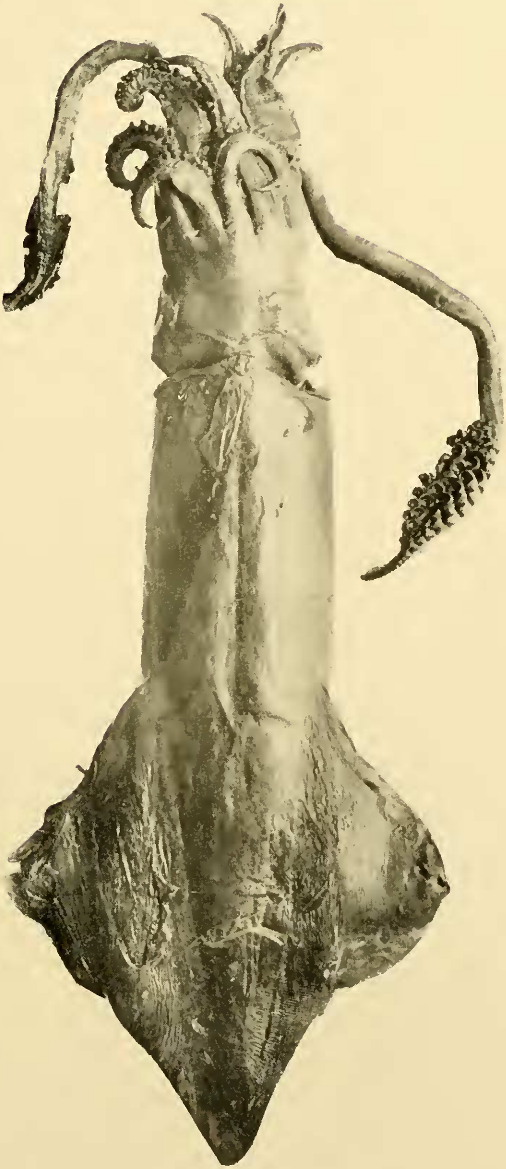
EXPLANATION OF PLATE LXVII.

Loligo etheridgei, ♂.

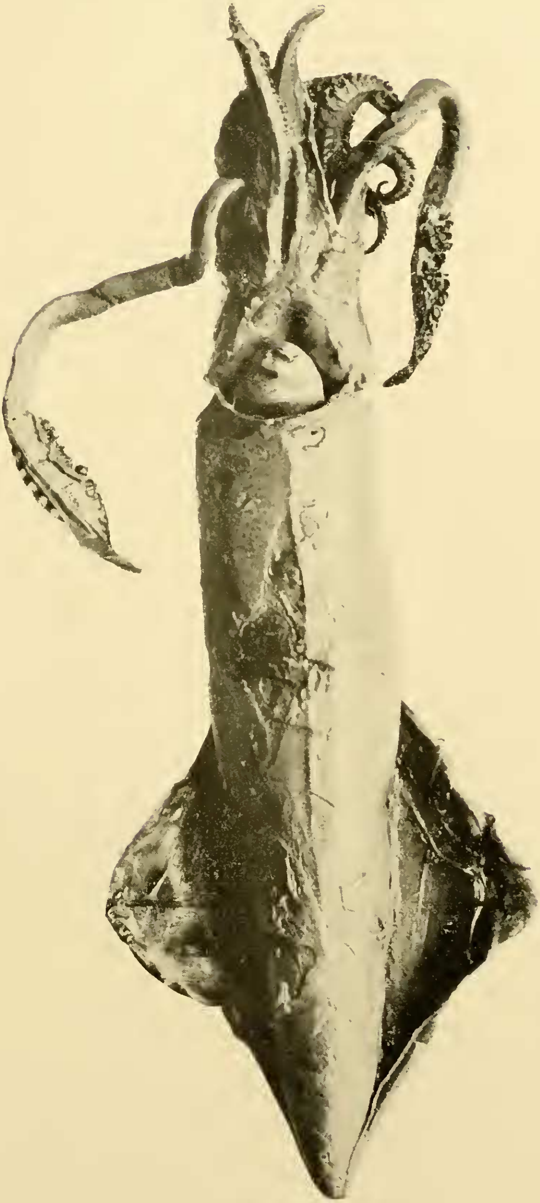
Dorsal aspect of type specimen [489], × ca. $\frac{9}{10}$.



EXPLANATION OF PLATE LXVIII.

Loligo etheridgei, ♂.

Ventral aspect of specimen figured on preceding plate; same scale.



EXPLANATION OF PLATE LXIX.

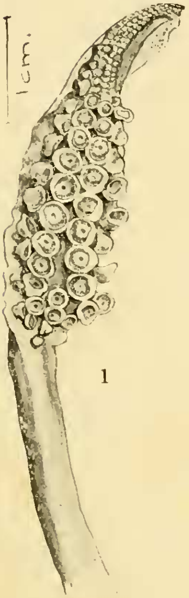
(All the figures on this plate were drawn by R. N. Wenzel.)

Fig. 1.—*Loligo etheridgei* ♂ [489], oral face of right tentacle club of type.

Fig. 2.—*Loligo etheridgei* ♂, distal portion of left ventral arm of same specimen, showing hectocotylization.

Fig. 3.—*Rossia australis* ♂ [538], outer lateral aspect of left dorsal arm of type, showing hectocotylization. Several missing suckers are not supplied in the drawing.

Fig. 4.—*Rossia australis* ♂ [538], oral aspect of arms and tentacle of right side of type. Several missing suckers are not supplied in the drawing.



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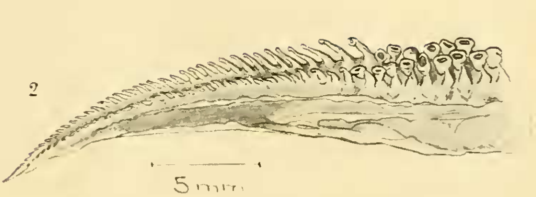

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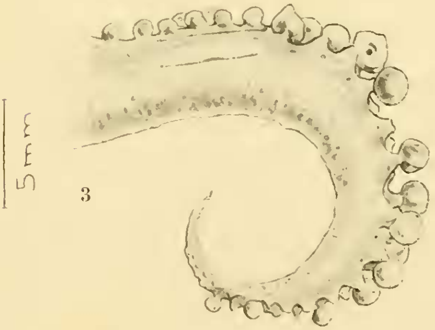

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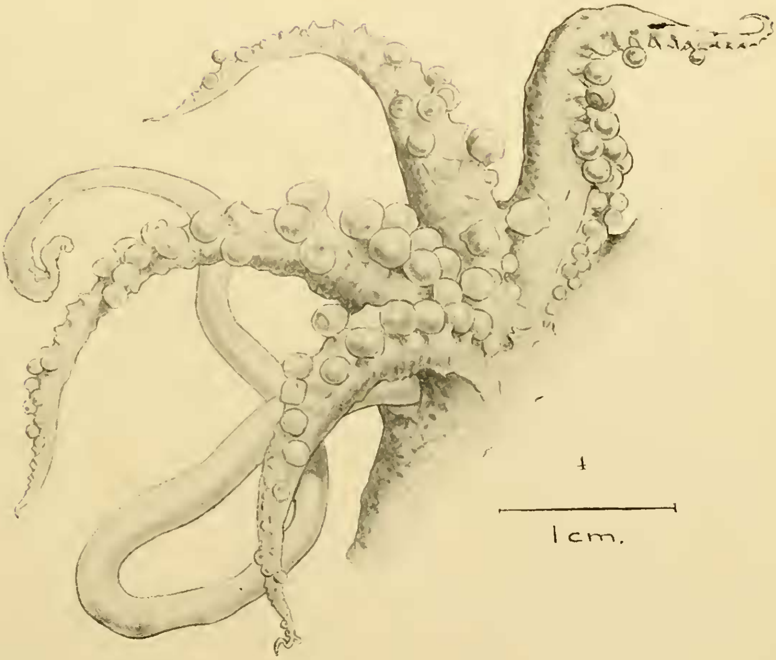

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EXPLANATION OF PLATE LXX.

Rossia australis.

Fig. 1.—Outline view of ♀ paratype [539], dorsal aspect.

Fig. 2.—Dorsal aspect of type specimen, ♂ [538].

Fig. 3.—Nuchal cartilage of ♀ [540].

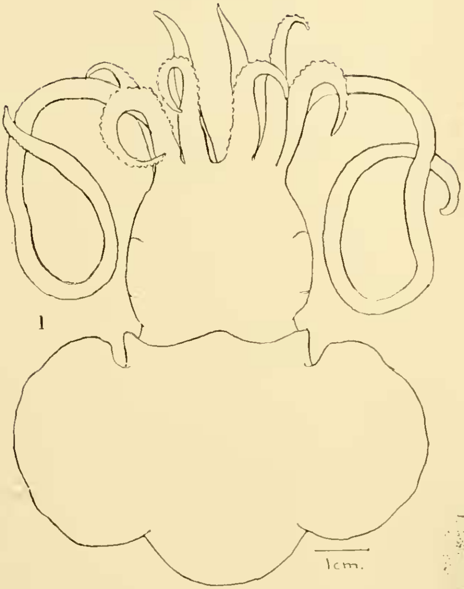
Fig. 4.—Right funnel cartilage of same specimen; same scale.

Fig. 5.—Oral aspect of right dorsal arm of type specimen ♂ [538], showing hectocotylization.

Fig. 6.—Oral aspect of left second arm of ♀ [540].

Fig. 7.—Oral aspect of right tentacle club of same specimen.

Fig. 8—Funnel of ♀ [540], laid open along medio-ventral line to show funnel organ.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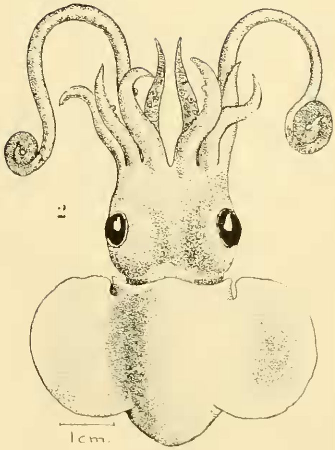
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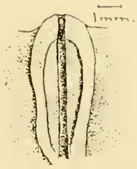
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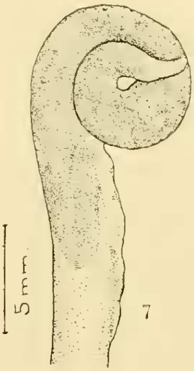
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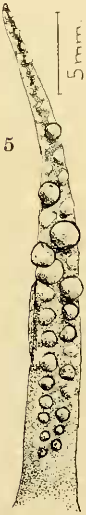
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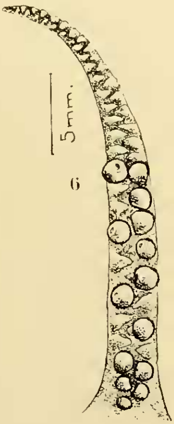
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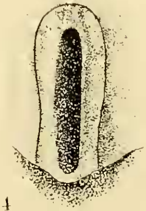
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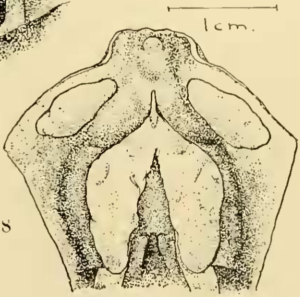
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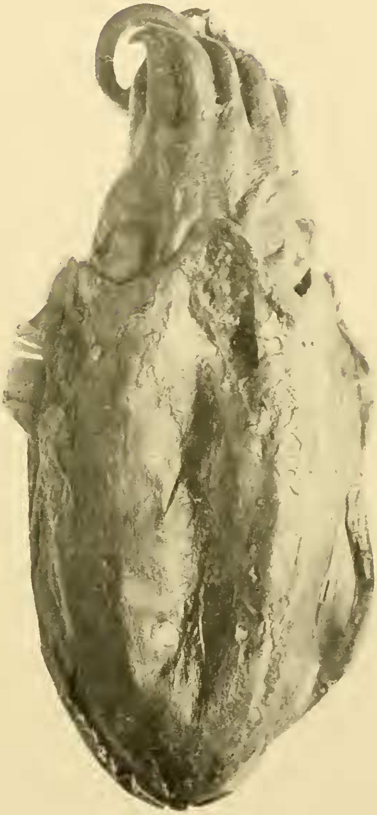
EXPLANATION OF PLATE LXXI.

Sepia hedleyi, ♂.

Dorsal aspect of type specimen [499]; approximately natural size.



EXPLANATION OF PLATE LXXII.

Sepia hedleyi.

Fig. 1.—Ventral aspect of type specimen ♂ [499].

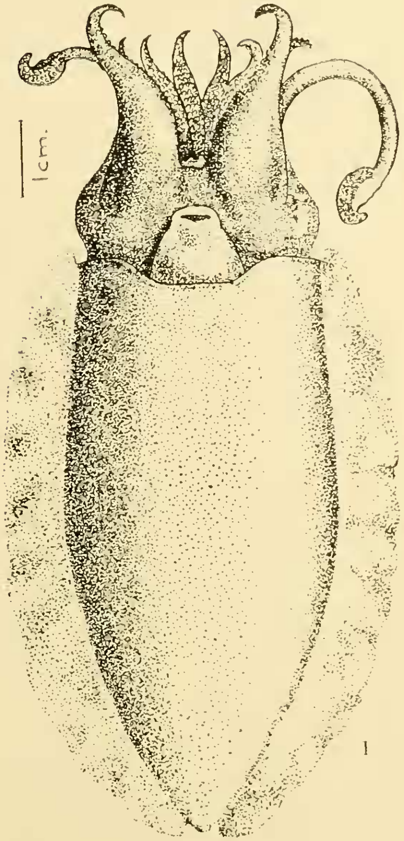
Fig. 2.—Reconstructed figure of sepiostaire of ♀ [507], ventral aspect.

Fig. 3.—Left tentacle club of type specimen ♂ [499].

Fig. 4.—Right tentacle club of ♀ [491].

Fig. 5.—Apical region of same, drawn under higher magnification.

Fig. 6.—Oral face of left ventral arm of type specimen ♂ [499], showing hectocotylization.



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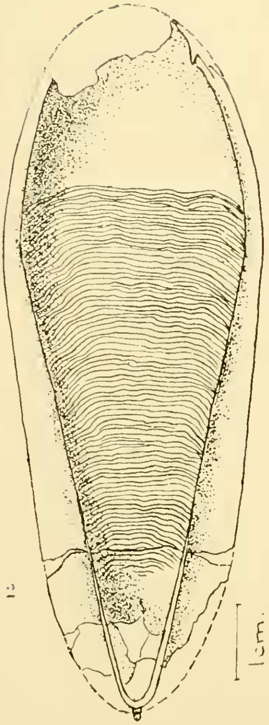

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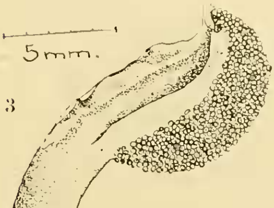

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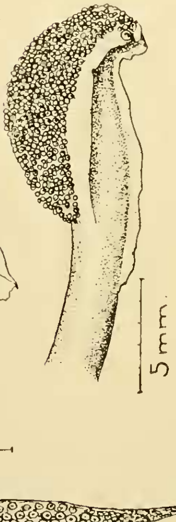

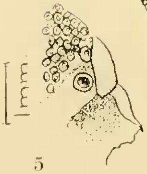

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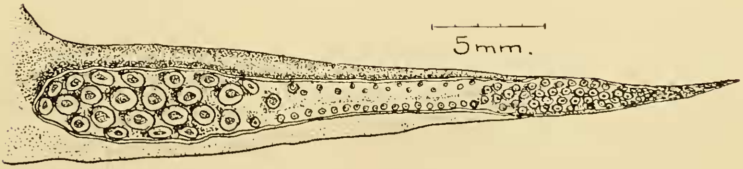
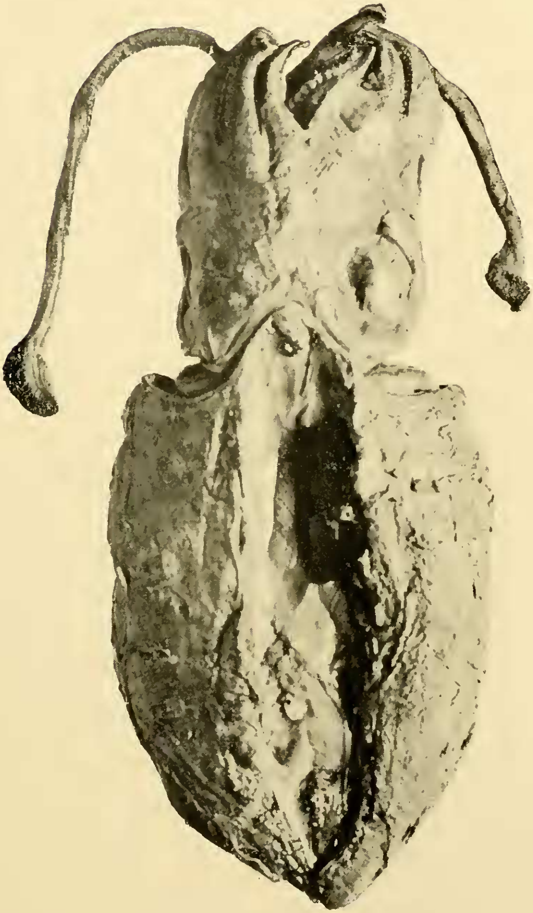


EXPLANATION OF PLATE LXXIII.

Sepia dannevigi, ♀.

Dorsal aspect of type specimen [493]; approximately natural size.



EXPLANATION OF PLATE LXXIV.

Fig. 1.—*Sepia dannevigi* ♀ [493], ventral aspect of type specimen.

Fig. 2.—*Sepia dannevigi* ♀ [493], left tentacle club of type specimen. Drawn by R. N. Wenzel.

Fig. 3.—*Sepia chirotrema* ♀ [524], dorsal aspect of head.

Fig. 4.—*Sepia chirotrema* ♀ [524], right tentacle club of same specimen. Drawn by R. N. Wenzel.

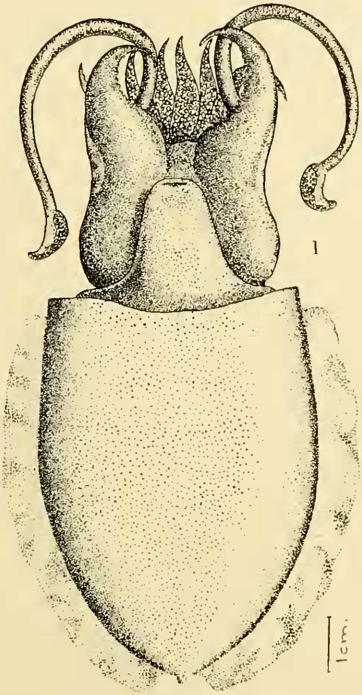
Fig. 5.—Same in lateral view to show the fenestræ in the marginal fold ; same scale.

Fig. 6.—*Sepia chirotrema* ♂ [522], oral face of left ventral arm of type specimen, showing hectocotylization.

Fig. 7.—Oblique lateral view of portion of distal region of same under greater magnification.

Fig. 8.—Oral aspect of distal portion of same ; same scale as Fig. 7.

Fig. 9.—Schematic cross-section of arm in same region ; same scale.



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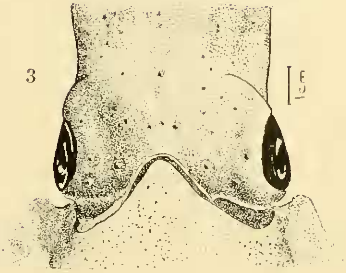

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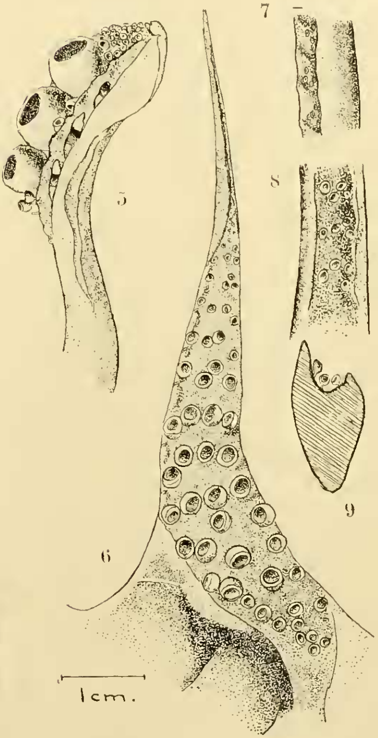

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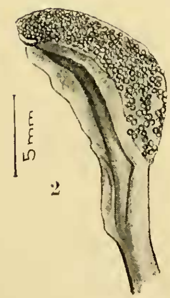

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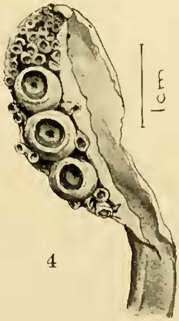

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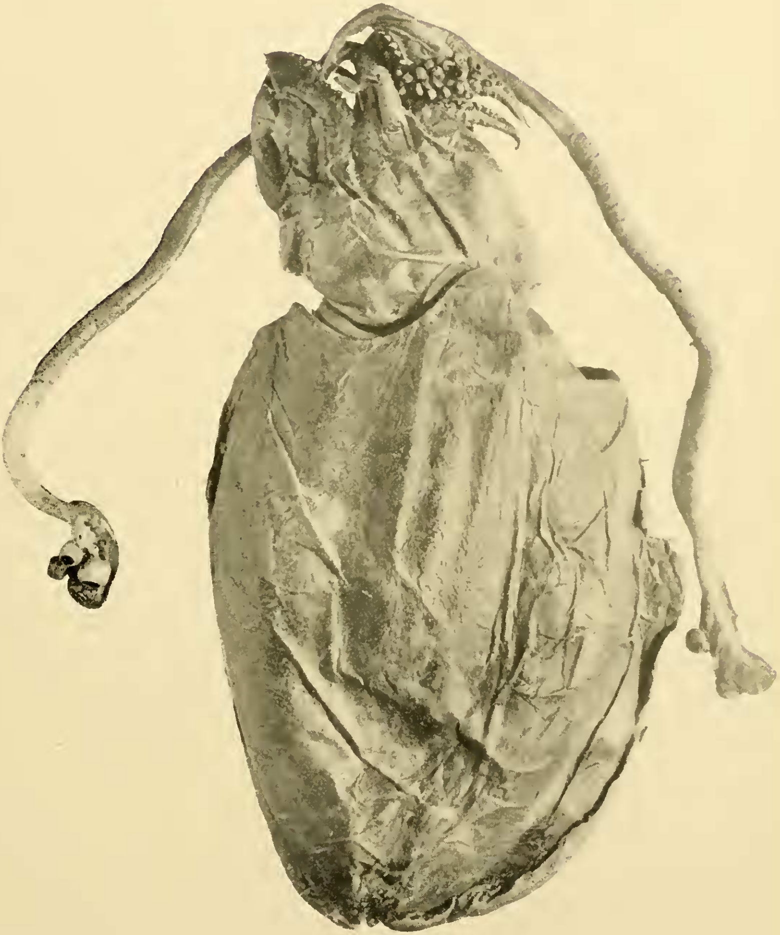
EXPLANATION OF PLATE LXXV.

Sepia chirotrema, ♂.

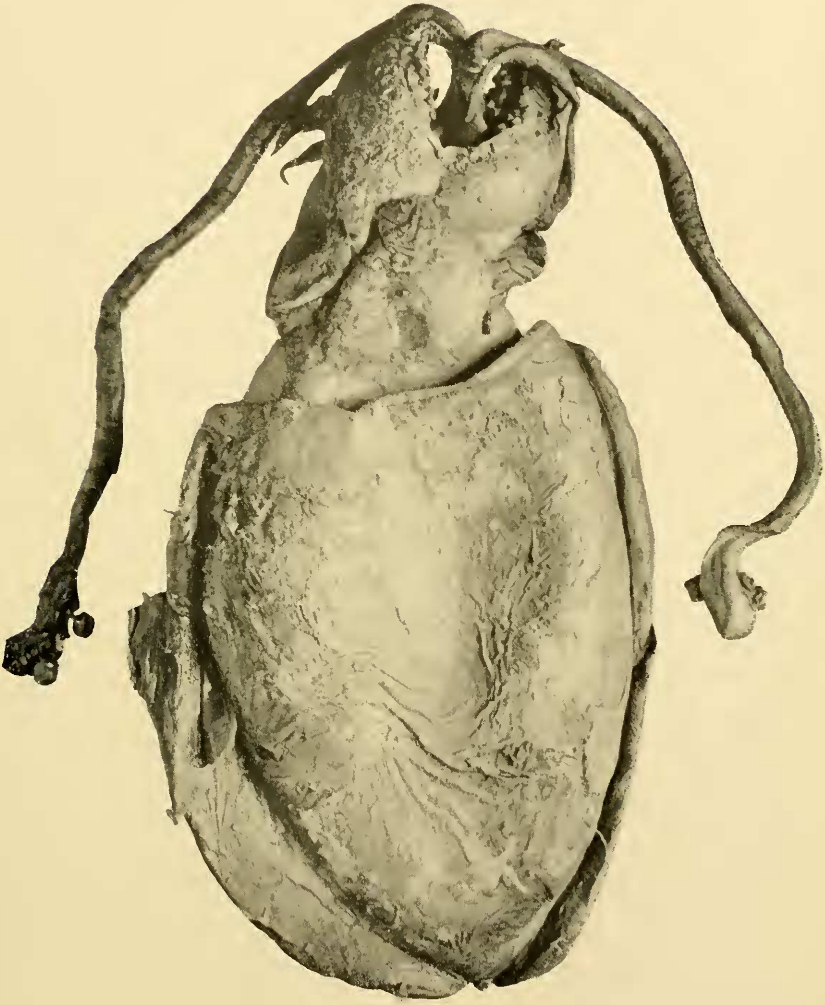
Dorsal aspect of type specimen [522]; × ca. ½.



EXPLANATION OF PLATE LXXVI.

Sepia chirotrema, ♂.

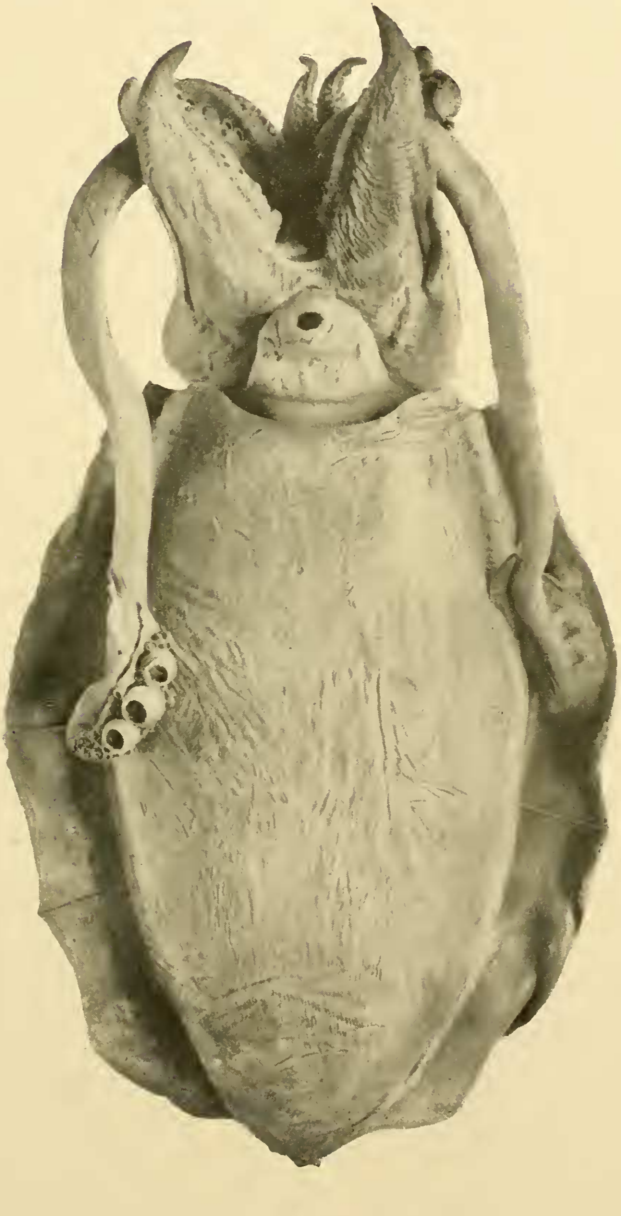
Ventral aspect of type specimen [522]; × ca. $\frac{1}{2}$.



EXPLANATION OF PLATE LXXVII.

Sepia chirotrema, ♀.

Ventral aspect of large ♀ [524]; × ca. $\frac{2}{3}$.

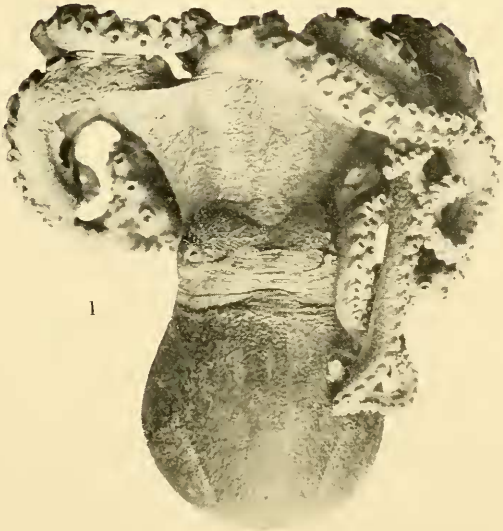


EXPLANATION OF PLATE LXXVIII.

Fig. 1.—*Polypus*, cf *australis* ♀ [536], dorsal aspect of small specimen from 200 fathoms, south of Gabo Island; slightly more than natural size.

Fig. 2.—Lateral aspect of same; same scale.

Fig. 3.—*Polypus* sp. juv. [533], lateral aspect; slightly more than natural size.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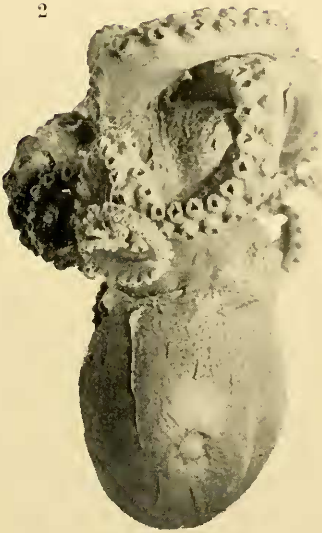

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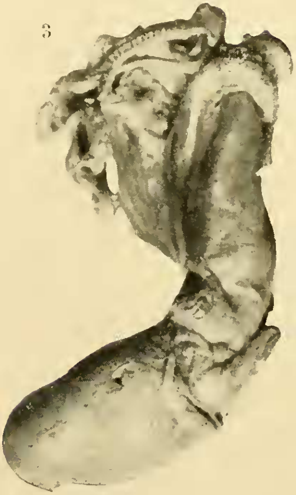
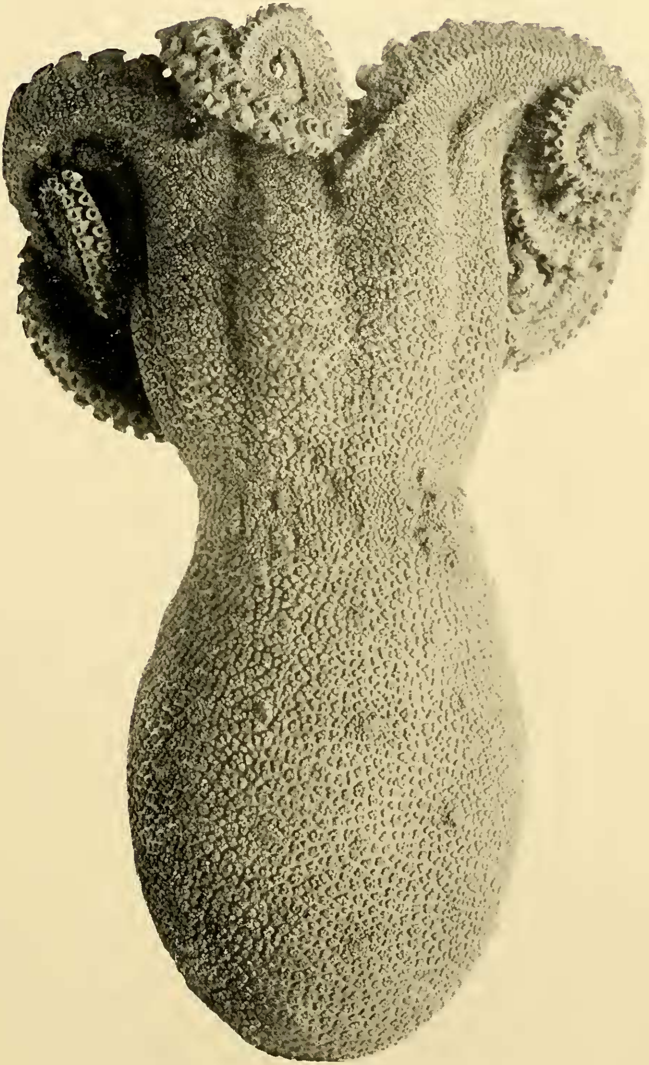


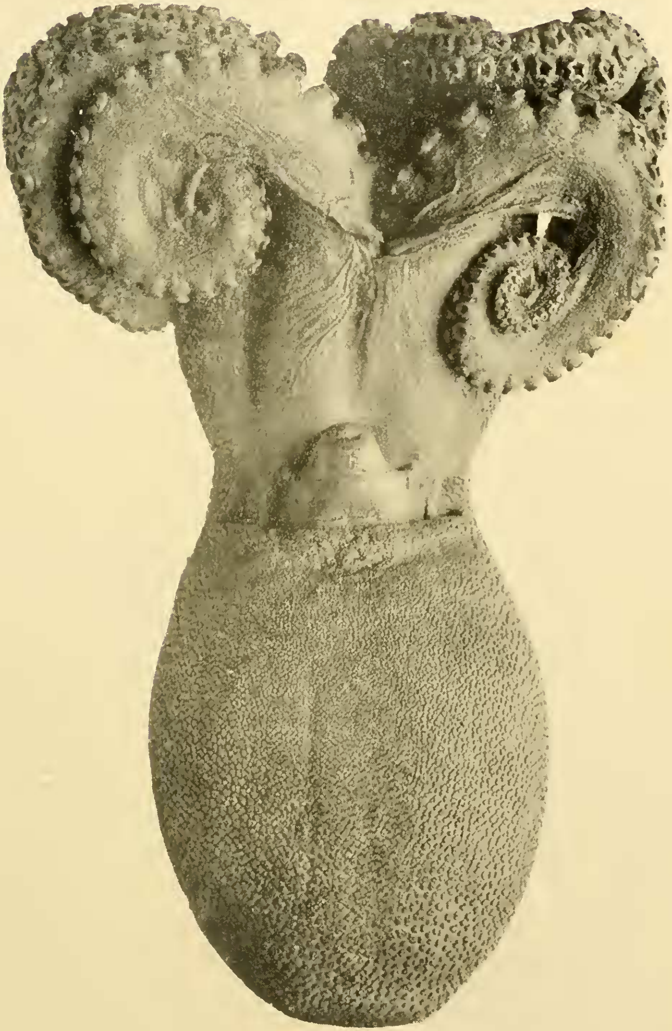
EXPLANATION OF PLATE LXXIX.

Polypus variolatus, ♀.
Dorsal aspect [528]; × $\frac{3}{4}$.



EXPLANATION OF PLATE LXXX.

Polypus variolatus, ♀.
Ventral aspect [528]; × $\frac{3}{4}$.



EXPLANATION OF PLATE LXXXI.

Fig. 1.—*Polypus*, cf *australis* ♀ [536], funnel laid open along medio-ventral line to show the funnel organ. Drawn by R. N. Wenzel.

Fig. 2.—*Polypus variolatus* ♂ [527], funnel laid open along medio-ventral line to show the funnel organ. Drawn by R. N. Wenzel.

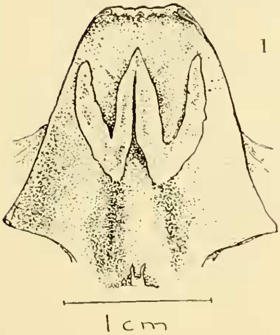
Fig. 3.—*Polypus variolatus* ♂ [527], portion of oral face of left second arm (sucker pairs 6-19 inclusive), showing enlargement of certain suckers.

Fig. 4.—*Opisthoteuthis pluto* [468], an areola in the systole state from integument of aboral surface of a medium sized specimen.

Fig. 5.—Another areola from same specimen, showing diastole condition ; same scale.

Fig. 6.—*Opisthoteuthis persephone* [478], an areola in the systole state from integument of aboral surface of small specimen from 150 fathoms, south of Eucla.

Fig. 7.—*Opisthoteuthis persephone* [480], an areola in the diastole state from integument of aboral surface of type specimen ; same scale as last.



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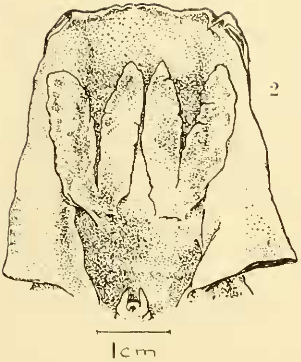

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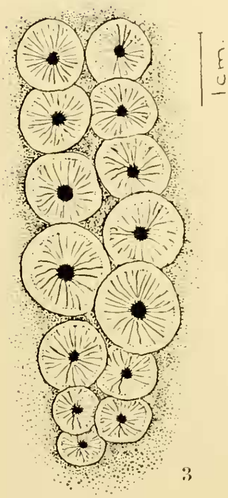

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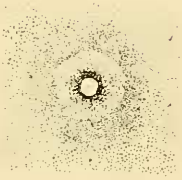

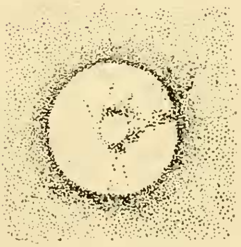

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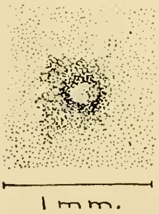

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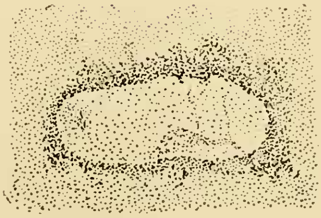


EXPLANATION OF PLATE LXXXII.

(All the figures on this plate were drawn by R. N. Wenzel.)

Fig. 1.—*Polypus variolatus* ♂ [527], oral aspect of hectocotylus.

Fig. 2.—*Polypus variolatus* ♀ [528], large supraocular cirrus of left side.

Fig. 3.—Papillæ from near middle of dorsum of same specimen; same scale.

Fig. 4.—Region of left eye of same specimen.

Fig. 5.—*Opisthoteuthis pluto* [464], 14tu-16th suckers of right dorsal arm of type specimen; cirri extruded.

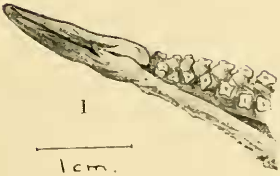
Fig. 6.—*Opisthoteuthis pluto* [468], 21st-22nd suckers of right dorsal arm; cirri partially retracted.

Fig. 7.—*Opisthoteuthis pluto* [468], pteropallial cartilage seen in situ from above (muscle of left side removed).

Fig. 8.—Right lateral portion of same preparation after excision, oblique lateral view; same scale.

Fig. 9.—*Opisthoteuthis persephone* [480], 7th-22nd suckers of right dorsal arm of type specimen; cirri retracted.

Fig. 10.—*Opisthoteuthis persephone* [484], pteropallial cartilage seen in situ from above.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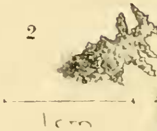
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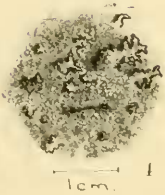
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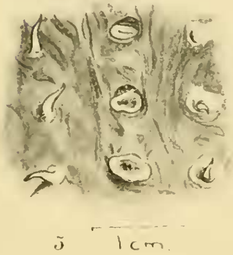
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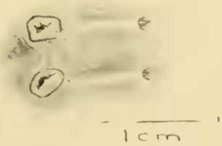
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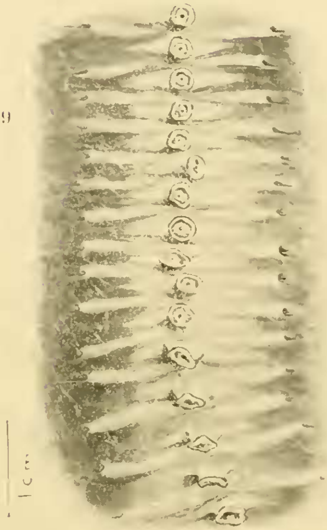
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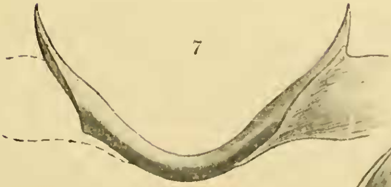
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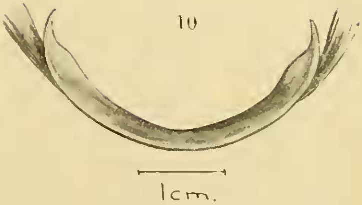
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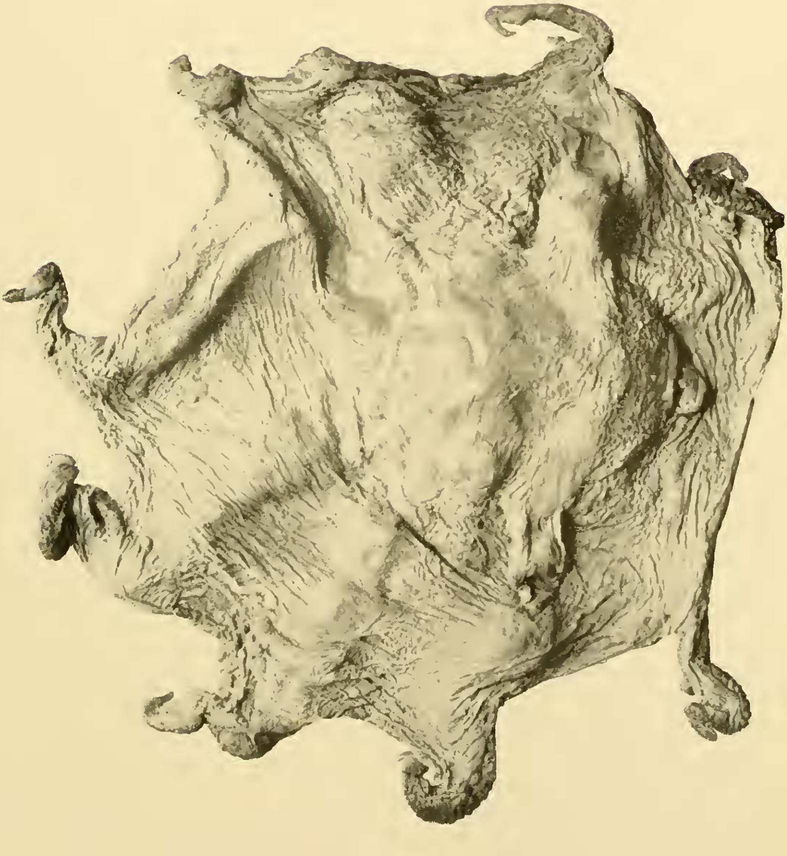
EXPLANATION OF PLATE LXXXIII.

Opisthoteuthis pluto.

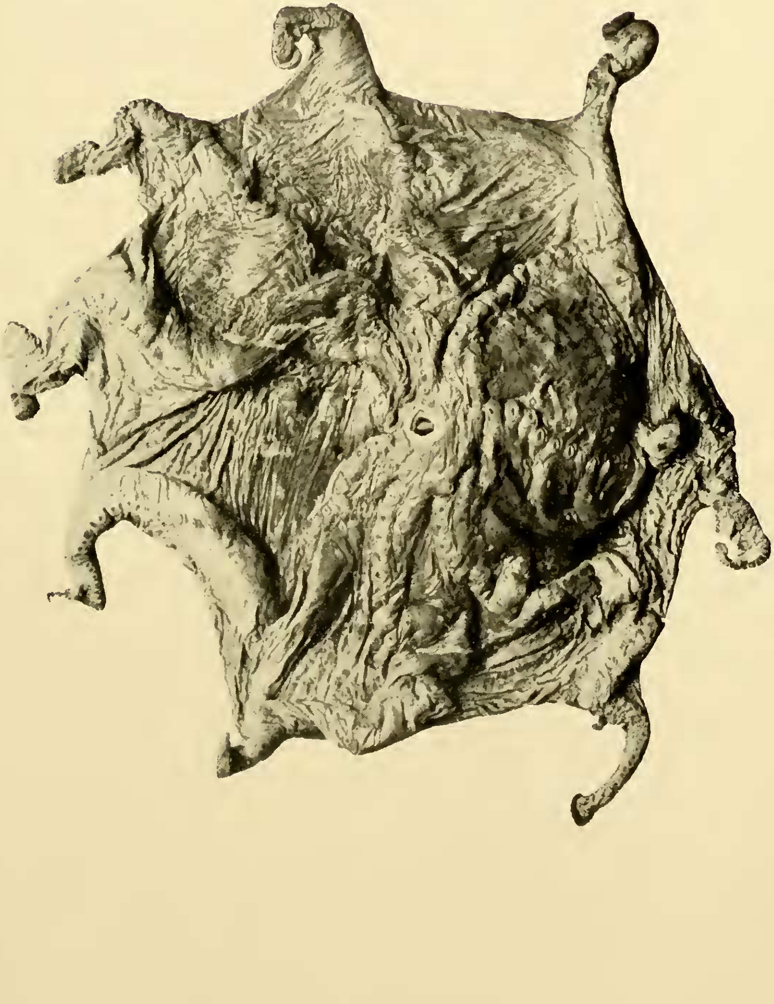
Aboral aspect of type specimen [464]; × $\frac{1}{3}$.



EXPLANATION OF PLATE LXXXIV.

Opisthoteuthis pluto.

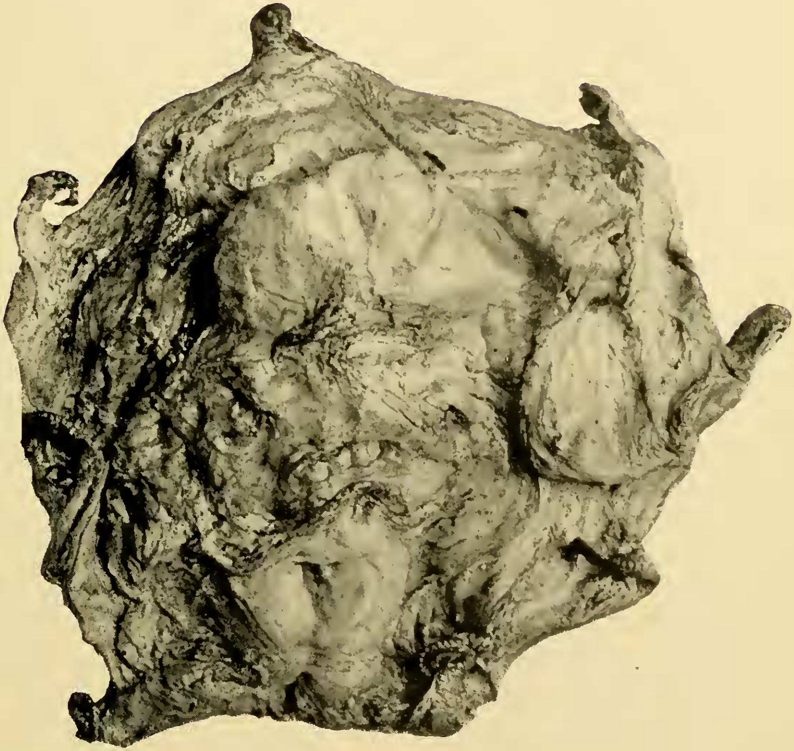
Oral aspect of type specimen [464]; × $\frac{1}{3}$.



EXPLANATION OF PLATE LXXXV.

Opisthoteuthis persephone.

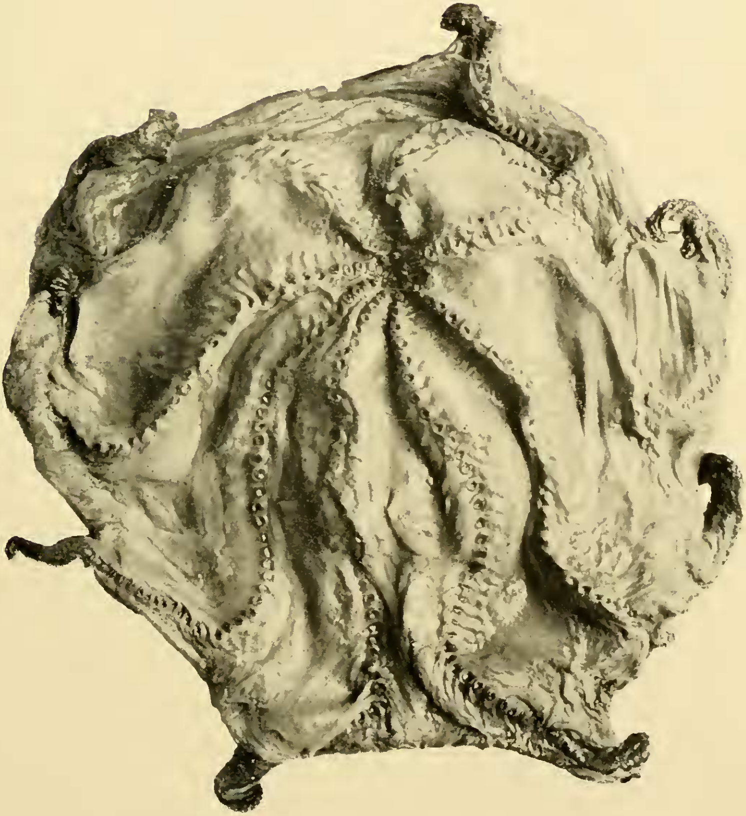
Aboral aspect of type specimen [480]; much reduced.



EXPLANATION OF PLATE LXXXVI.

Opisthoteuthis persephone.

Oral aspect of type specimen [480]; much reduced.

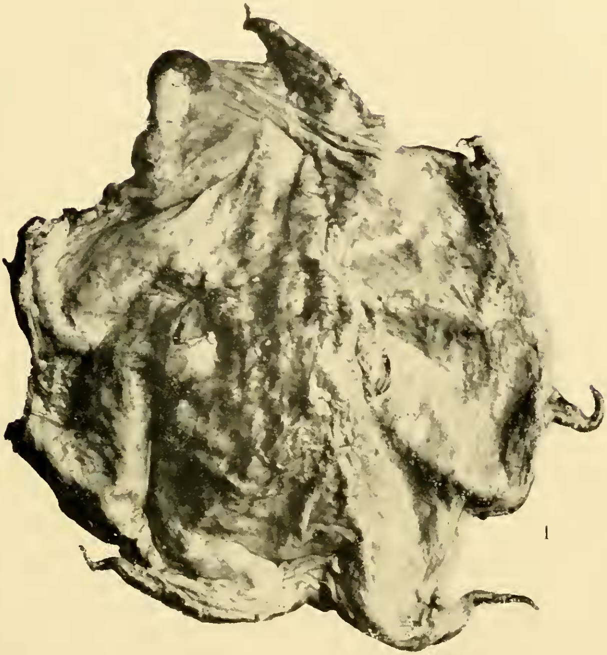


EXPLANATION OF PLATE LXXXVII.

Opisthoteuthis persephone.

Fig. 1.—Aboral aspect of small discoid specimen from 150 fathoms south of Eucla [477]; somewhat reduced.

Fig. 2.—Lateral aspect of paratype [481]; same scale.



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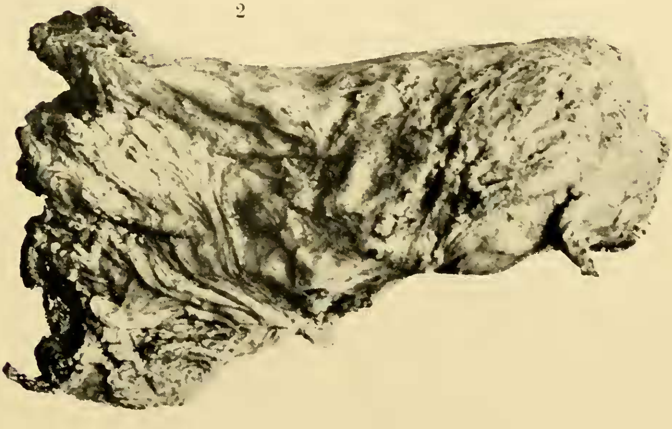
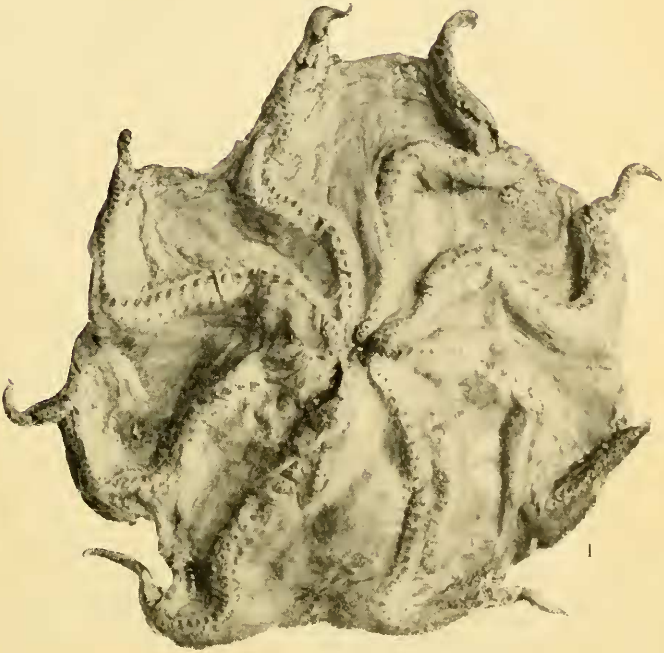


EXPLANATION OF PLATE LXXXVIII.

Opisthoteuthis persephone.

Fig. 1.—Oral aspect of small discoid specimen from 150 fathoms, south of Eucla [477]; somewhat reduced.

Fig. 2.—Oral aspect of paratype [481]; same scale.



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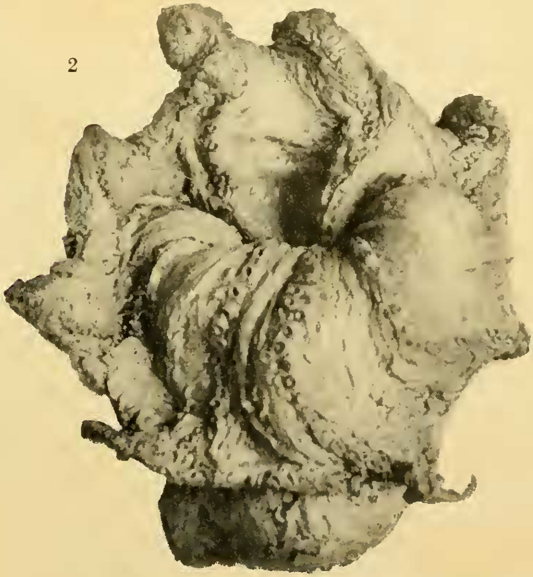

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